

# CHEMICAL & METALLURGICAL ENGINEERING

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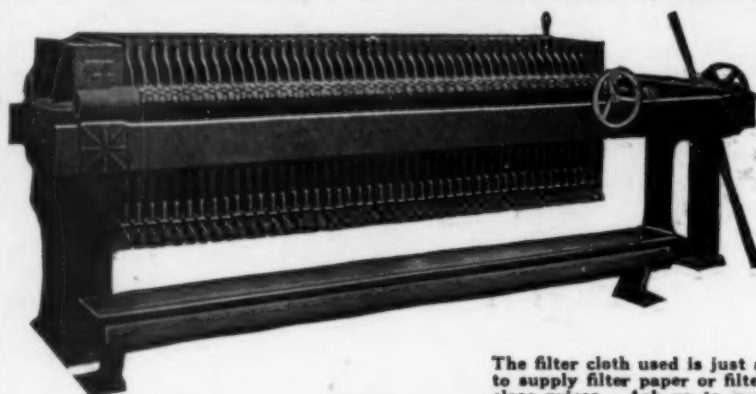
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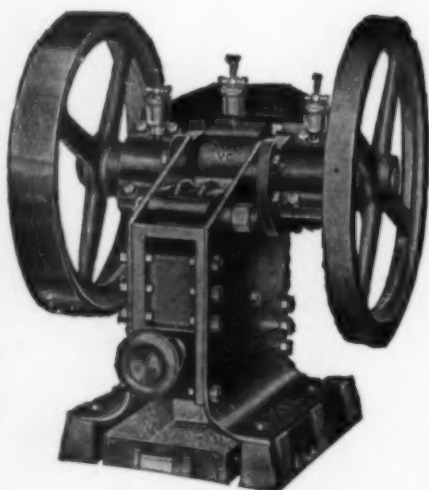
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# CHEMICAL & METALLURGICAL ENGINEERING

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## Demand on Chemical Foundation For Return of German Patents

WHEN a bomb explodes, either literally or figuratively, a close observer will at first be conscious only of a series of scattered and disconnected impressions. Afterward a coherent story comes out of the experience. That is exactly what happened in the chemical industry when President HARDING's letter to the Alien Property Custodian was published last Saturday. The President directed him to demand the return of all patents, trade marks, etc., sold to the Chemical Foundation, Inc., and to act upon the advice of the Attorney-General in carrying out the instructions. The Attorney-General has since subpoenaed the Foundation's books and papers before a grand jury in Washington.

The first reactions among those interested in the chemical industry and the Chemical Foundation were rather vague and indefinite. How much politics was involved in the President's order? What agencies had succeeded in thus crystallizing sentiment against the Chemical Foundation? Had that organization been guilty of anything not legally or morally straight in its transactions? What would be the effect of the President's order on the chemical industry, particularly the dye industry of the country? Were German propaganda and influence, as represented by dye importers, in any way responsible for persuading Washington to take this step? These and other questions flashed through the mind without apparently throwing any light on the situation. But out of all the speculation that has been rife we may now single a few outstanding facts and probabilities, and on them base with some degree of assurance a reasonable prediction.

The basis of the President's order is that "it appears that the sale was made at so nearly a nominal sum that there is reason to believe that this government has not faithfully observed the trust which was implied in the seizure of this property." No one can find fault with this basis for the demand. Under the trading with the enemy act, the Alien Property Custodian seized enemy property and held it in trust for its owners. Presumably that property or its value was at some time to be returned to those from whom it was seized. If it was sold, the sale presumably should have been at a price commensurate with the value of the property. The President, therefore, cannot be criticised for desiring "to maintain the sacred character of the trust to which the Alien Property Custodian is committed by the law." The natural consequence is, to use the President's own words, "that full investigation becomes a public duty."

By all means let's investigate and let the fullest publicity be given to the investigation. If, as in the case of Senator KING's investigation of the dye industry, the original charges prove to be fictitious, the Chemical Foundation will be more firmly established than ever.

If, on the other hand, it can be proved that more should have been paid for these patents than was paid under the direct orders and with the full approval of the government, then let a proper adjustment be made. But before any such settlement is made, and particularly before any charges of corruption and unfairness are entertained let all the facts be known. The Chemical Foundation has been under fire before now. Its scheme of organization, its methods of conducting business, its resources and the disposition of its income have been the subject of public inquiry. But if we were the Chemical Foundation we would not only welcome but would now demand a clean-cut investigation.

There can be no doubt, however, that behind the President's order there is some yielding to political clamor. Our Washington correspondent says that while there is no tendency to charge ulterior motives to the Administration, it is nevertheless felt that the Attorney-General, who has been subject to repeated attacks in Congress, welcomes any action that will serve as a smoke screen to divert from him the unwelcome attention he has been receiving. Further, there is in Congress a group of partisans, mainly Republicans but with some Democratic adherents, who would like nothing better than to see former Attorney-General PALMER and former Alien Property Custodian GARVAN skinned out of their political hides. Finally, there is the ever-present animosity of dye importers whose views sometimes find favor in strange political quarters.

But what will be the ultimate result and the intervening consequences of the President's order? It may almost be set down as a certainty that the Chemical Foundation will never return or be obliged to return the property it bought. The men who organized it and the chemical companies who are stockholders in it have as good business and legal minds as there are in the country, and it is not likely that they would have invested capital or taken licenses on patents if the business were on so flimsy a basis as to be summarily overthrown. As to the intervening consequences, the legal battle that will follow the demand of the Alien Property Custodian is certain to be long and tedious, for there is no better legal talent in the country than will be arrayed against the Attorney-General in this case.

It is, of course, unfortunate that the President issued his order at this time, because it may seriously affect matters of great importance to the chemical industry now pending in Congress, notably the dye embargo. As for production under the licensed patents, however, it seems unlikely that this will be adversely affected, because arrangements undoubtedly can be made for licensees to continue manufacture under a court order for periodical accounting. Temporary disturbance seems inevitable, but in the end we hope for a clean-cut verdict—a vindication or a conviction.

### "Seein' Things at Night"

#### In Our Patent System

EVER since the war revealed the deplorable dependence of our organic chemical industries, notably the making of dyes, Congress has made recurring attempts to modify our patent system by compelling patentees to work their patents in the United States within a period of 2 to 5 years on pain of granting licenses to others who would put them into productive operation. The motive behind these various proposals has been to prevent foreigners from patenting their inventions in the United States and then operating them in their own countries and exporting the products to America.

It is an old bugaboo—this fear of foreign brains and ingenuity—and one that will not be laid low by the proposed compulsory working and compulsory licensing amendments to our patent law. England has experienced and survived the same fears. The United States enacted a compulsory working clause in 1832, but repealed it in 1836. Since then attempts to enact similar legislation have been made by OLDFIELD in 1912, PAIGE in 1915 and STANLEY in 1921 and 1922.

Senator STANLEY has been particularly persistent in his efforts. His first bill, in 1921, proposed to compel foreigners who patented their inventions in the United States to put them "in operation so as to result in actual production" in this country within a period of 2 years from the date of issue, failing which the United States would reserve the right to license anyone for purposes of domestic manufacture. This bill was invalid because it violated the International Convention for the Protection of Industrial Property, to which the United States is a party and which has been interpreted to mean that any country which is a party to the Convention cannot discriminate against foreign nationals of Convention countries. So Senator STANLEY redrafted his bill to provide that "any patent . . . shall contain a proviso to the effect that if such patent . . . is not worked or put in operation so as to result in actual production in the United States . . . within a reasonable time from the date of its issue . . . the United States reserves the right to license any person or persons for purposes of manufacture in the United States." This proposal aroused considerable opposition and on April 20, 1922, Senator STANLEY proposed a further amendment providing in effect that if a United States patentee fails to work his invention in this country within 2 years of the issuance of his patent, and if it is worked in a substantial manner in a foreign country, he can be compelled, on the petition of any reputable American citizen or business organization brought in the U. S. Circuit Court of Appeals, to grant a license to the petitioner upon equitable terms.

We regard this proposal as pernicious regardless of its various legislative forms, and are firmly of the opinion that if enacted into law it would, in the long run, have a baneful influence on American chemical industry. It is true that the Stanley bill apparently has received some substantial support from the Manufacturing Chemists Association, the American Institute of Chemical Engineers, and lately from the American Chemical Society. But we think it is fair to point out that this support comes from laymen and not from those who are most familiar with patent procedure. Further, that most of the support is due to the activities of Mr. HENRY HOWARD, whose energy and determination we admire, but with whom we are obliged to differ on this question. An imposing array of testimony

against the measure has been collected and published by the American Patent Law Association giving almost indisputable proof of the futility and folly of the bill. The reader will also find on another page in this issue a thoughtful analysis of the consequence of compulsory licensing, prepared by Dr. D. B. KEYES.

Incidentally, the support apparently given by the American Chemical Society does not carry conviction. The action was taken by the Committee on National Policy in opposition to the advice and opinion of the society's Patent Committee. It was reported editorially under the misnomer "Patent Progress" in the June issue of the *Journal of Industrial and Engineering Chemistry*. Reading between the lines, one may conclude that the editor had but little heart for this particular job, for he wrote a halting and apologetic defense of the action of the Committee on National Policy in overriding the more expert advice of its Patent Committee. The chairman of the latter, Mr. E. J. PRINDLE, naturally resigned. The editor further was misled into stating that the STANLEY bill as now amended "applies only to American patents which are also taken out in foreign countries (less than 10 per cent)." Such is not the case. Senator STANLEY's latest amendment provides that "2 years after issuance of any United States patent . . . if it is shown that the invention covered by such patent is being worked in substantial manner in a foreign country, and that the owner thereof has failed to work it in the United States . . . then on the petition of any reputable American citizen, corporation or partnership . . . the court shall order a non-exclusive license granted to the petitioner." The wording is so clear as to preclude misunderstanding, and the proponents of the measure use a specious argument in claiming that the bill applies only to American patents which are also taken out in foreign countries. It applies to any American patent. Yours, for instance!

Isn't it true that fear of the foreigner, and particularly the German dye chemist, is at the bottom of this move? Isn't it the purpose to erect another artificial barrier like the tariff or the dye embargo? No voice has been raised louder than ours in behalf of an American organic chemical industry. But in all the effort that has been made to obtain a protective tariff, even an embargo, for the dye industry of this country it has been clearly recognized that time is the essential element to permit us ultimately to meet foreign competition. It has been our boast that we have the brains, the ability and the materials. All we have asked is time in which to solve our problems, and it has been assumed that we would work out our own salvation.

But we cannot always support a spoon-fed industry. Some time we must quit playing with palliatives. Some time we shall have to stop nursing the industry along with business nostrums. Sooner or later we must depend upon research and development, and these will not be fostered by the Stanley bill in any of its forms. Under the Stanley bill industrial research will wane because it will be cheaper to take licenses; chemical education will not thrive because there will be no demand for chemists; the poor inventor will become extinct because corporations looking for licenses can easily bring him to terms; and as for the national defense, we shall be quite at the mercy of the nations that conduct research and from which we take licenses. In short we shall develop a fine case of fatty degeneration of industry in the United States.

In our judgment the Stanley bill is not only per-



nicious but it is short-sighted and futile. It is looking for something for nothing. Instead of indorsing it our chemical industry should oppose it; and as for the War Department, Secretary WEEKS will be well advised to turn his attention to organized and continuous research and see that the Chemical Warfare Service is supplied with adequate funds for the purpose.

Let's quit "seein' things at night" and go to work! Let's quit breaking up technical organizations and start on a campaign of supporting chemists and research. Let's quit worrying about the other fellow and do some thinking on our own account. Let's quit tinkering with the patent system and make use of a plan that, with all its faults, has developed and fostered the inventive ingenuity of the American people. Compulsory working or compulsory licensing will never foster a dye industry or any other chemical industry in this country.

### "Blue" Gas for Heating Coke Ovens And Other Industrial Furnaces

IT HAS been customary to heat coke ovens with a portion of the gas driven off from the coal treated in them. In some cases use is made of the lean-gas produced in the latter portion of the carbonizing period, in others a portion of the run-of-oven gas is used. But in either case only about half of the total gas output is available for use elsewhere in the plant or for sale. In fact, this "surplus" is often much less than half the total and rarely exceeds 60 per cent of the production.

As a consequence of this oven-heating practice, there has been little flexibility in coke-oven installations with respect to the ratio of yields of coke and of gas. Some variation is possible by increasing or decreasing the coking time, but the change in the ratio is not large. The newer idea, which has been applied in a number of plants recently, has been to heat the ovens with producer-gas or blue-gas made in outside generators. When operating on this scheme all of the oven-gas can be considered "surplus," or a part of it may be used for heating the ovens, as conditions may determine.

Where there is a ready market at a good price for practically all the gas made in the coke oven, this separate system of heating is of great importance. And in localities where the controlling product from the ovens is really gas, because this is used in public utility distributing systems, flexibility in gas output relative to coke production is of greatest importance. This has been a question of great financial concern during the past year or two when the demand for gas in such plants continued about as formerly, but the market for coke was at a very low ebb, in some cases almost nil.

In one or two plants gas producers have been installed to meet this situation, and producer gas is now used for heating the ovens part or all of the time. The use of blue-gas, however—that is, uncarburetted water gas—has under certain circumstances distinct advantages over the use of producer gas. The blue-gas can, if necessary in an emergency, be mixed with coke-oven gas and distributed through the public utility system. Thus the blue-gas generator affords standby equipment for the gas system as well as an agency permitting greater flexibility in the operation of the coke ovens. Moreover, both gas producer and blue-gas generator are coke consumers as well as gas-making devices; thus either serves doubly in the effort to reduce the coke output relative to gas output when this is a desirable end.

The plant of one local company which has met this situation very successfully is described by an article in this

issue. The results presented by Mr. O'MALLEY in that article will be of interest to members of the gas industry and coke-oven operators generally. They should also appeal strongly to many chemical industries that have a problem of fuel gas to consider.

Blue-gas is one of the finest industrial fuels. Its manufacture on a small scale is possible either with continuous or intermittent operation of the generator. Industrial application of blue-gas has not been general, but more attention should be given to the possibilities of this very fine fuel. Those who have high-temperature heating problems will do well to study particularly the chart in Mr. O'MALLEY'S article, which shows the advantages of blue-gas.

### As It Was In the Beginning?

IT WAS our good fortune to spend our earlier days in a small country town. Without making any invidious comparisons we shall always hold that there can be no better place in which to grow up. There are, however, certain aspects of village life which are not, perhaps, as fine when you have to live through them as they are humorous when you look back upon them.

As a case in point, there was Uncle Billy Palmer. Uncle Billy was our village rich man—the man who owned the most property, paid the largest tax, and, consequently, whose word carried the greatest weight in town meeting. He held, in the eyes of the village, a position of Czar and Grand Pooh Bah rolled into one.

From time to time the even flow of life in our town would be disturbed by an outbreak of typhoid. This was in the days before anti-typhoid inoculation was known and when the means of prevention through sanitation were only in their infancy. After much search, the spread of the disease was, however, traced to the contamination of certain wells and a town meeting was called to see what could be done.

The general opinion of the meeting was that a sewerage system should be installed and estimates were called for from the county engineer. But here the meeting met a snag. Uncle Billy fought the proposition tooth and nail. His father and his grandfather before him, he said, had got along without sewers and he'd be eternally danged if he'd ever stand for such new-fangled notions. To make a long story short, the town got no sewers until Uncle Billy was gathered to his fathers. Health and happiness were compelled to wait on stubborn conservatism and old-fashioned ideas.

This tale holds a lesson for those of us who control the affairs of an age which we like to think of as enlightened and progressive. You will find in this same issue an account of what one company has done toward progress in the manufacture of porcelain. This has been accomplished in spite of the strongest kind of opposition from porcelain men within this company, and under the ridicule and doubt of porcelain manufacturers in general. Since the new system of manufacture has proved successful the general attitude of the industry has been that it may work in that particular plant, but it would never work in any other.

Are those responsible for production methods in the porcelain industry going to be unclebillypalmeres and compel progress to await their demise? Or are they going to see the light of a new day of manufacture, and by bringing their methods up-to-date, place themselves in a position to compete with foreign products.

## Readers' Views and Comments

### The Stanley Patent Bill

*To the Editor of Chemical & Metallurgical Engineering*

SIR:—On May 13, 1922, the committee on national policy of the American Chemical Society unanimously adopted a resolution stating that the society was "in favor of the principle of the Stanley bill, S. 3410, as amended April 20 (calendar day May 4) 1922." This resolution, I understand, was unanimously opposed by the patent committee of the society. Evidently there is a difference in opinion as to what really is the "principle" back of the Stanley bill.

The resolution adopted at that time also stated that the society suggested that "public welfare and the national defense" be considered of equal importance, if the bill is to be modified. It is important to consider the probable effect on the national defense and the public welfare if the bill should be passed as it now stands.

Briefly the bill states that if two years after an American patent is issued the invention is being worked in a foreign country and not in this country, the inventor must grant a license at reasonable terms to any American who desires it. The terms and the general question are to be decided by a United States Circuit Court of Appeals.

#### THE EFFECT ON INDUSTRIAL RESEARCH

The concern which employs a large staff of skilled research chemists might find it not only cheaper and more practical but also safer to buy from someone else the results of research. This last point needs some explanation.

It has been stated that the bill will affect only those patents for which there are corresponding foreign patents, and it is estimated that this includes only 10 per cent of our patents. This, however, is not the case. The bill makes no mention of a foreign patent, but does state that the invention must be in the process of being worked in a foreign country. In other words, the bill applies to *any* American patent that is not being worked in this country, if for any reason at all it is being worked in a foreign country. There is no reason why an American who wishes to seize an unused U. S. patent should not prevail on some one to work the invention in a foreign country, or do it himself. Under the workings of the Stanley bill the American concern that has employed a large staff of skilled research chemists would discover that the value of the patents produced by their staff had diminished. Some of these patents would probably be seized by competitors. The natural attitude would be to discharge the research staff on buying the results of research work from others and especially from the Germans, who do all they can to foster research.

#### THE EFFECT ON EDUCATIONAL INSTITUTIONS

Professors and instructors in chemistry are hired by our universities to train young men to satisfy the demand of our chemical industries. Anything which affects this demand will affect the salary and number of professors employed. This bill gives the manufacturer

the privilege of buying the results of foreign investigators at a nominal sum. It is quite evident that the manufacturer will not fail to seize this opportunity and the need for American professors and instructors in chemistry will be diminished.

#### THE EFFECT ON SUBSIDIZED RESEARCH

The chemical manufacturer often pays universities, private institutions and consulting chemists to solve his problems. If he should suddenly find that he could purchase the solution at a lower figure from some foreigner, he would be inclined to do so. Business efficiency would demand it, even though our American research men would suffer. Industrial fellowships would be cut down to a minimum and the demand for American consulting chemists would become less.

#### THE EFFECT ON GOVERNMENT RESEARCH

Our own government, which employs a vast number of research workers, may also come to the conclusion that in many instances it will be cheaper to buy foreign ideas and the results of foreign research rather than to maintain large research organizations of its own.

#### THE EFFECT ON THE INDIVIDUAL INVENTOR

The research chemist, inventor and patentee who is not employed by any one else must be considered. His chances of obtaining adequate compensation for his work will be less than ever if the Stanley bill becomes a law. As I have already explained, a corporation can easily bring him to terms advantageous to itself by merely working the invention in a foreign country.

#### THE EFFECT ON THE NATIONAL DEFENSE

The War Department is interested in this bill because it believes there would be a tendency to prevent a foreign country from checking the development of American industries necessary in time of war. It is reasonable to suppose, however, should this bill be passed, that no foreign country would patent or disclose any invention absolutely essential in war. If the War Department is interested in the national defense, it is also interested in fostering chemical and scientific research in this country. Why then is it interested in a bill which will have a tendency to eliminate research in this country and foster it in some foreign country?

#### THE EFFECT ON THE PUBLIC WELFARE

The old bugaboo that German chemists are the finest in the world and no other nationality can successfully compete with them is heard again. One manufacturer believes that within ten years the Germans will be far ahead of the American in chemistry. They most certainly will if we eliminate our research men and pay the Germans to do the work for us.

It is evident to every American chemist that our chemical industry has a marked effect on the public welfare. If the Stanley bill becomes a law, it means that our chemical industry will steadily diminish and the American people will suffer.

D. B. KEYES.

New York, N. Y.



### Fullers Earth

To the Editor of Chemical & Metallurgical Engineering

SIR:—The article in your issue just received mentions incidentally that fullers earth absorbs basic dyes. There is a practical application of this property in the manufacture of "lime green," certain qualities of the English earths, generally the cheaper ones, giving superior results to the German "green earth" formerly used as the basis. The colored paste after absorption of the brilliant green tends to dry hard, but this is counteracted by admixture of the cheaper calcium sulphate. This admixture makes the color from all "green earths" I have tried go dull; with a suitable fullers earth it remains bright. The fastness to lime and light of the pigment produced varies with the source of the earth. As the coarseness of the usual product restrains use for paper staining, it would be worth while trying the fines mentioned for these and other applications.

A matter of more general interest is the specific difference the action of methylene blue and the basic triphenyl methane dyes. The pigment with brilliant green is turned a dirty brown permanently by vacuum drying, dried by hot air the color is soluble in alcohol; the methylene blue pigment regains its blue after vacuum drying, the color is insoluble in alcohol. This insolubility in alcohol may be connected with the ring structure, as it is exhibited to a lesser degree by acridine yellow.

Manchester, England.

E. F. MORRIS.

### Civil Sentiment Toward Chemical Warfare

To the Editor of Chemical & Metallurgical Engineering

SIR:—Evidence is accumulating that civil sentiment in the country with regard to chemical warfare is growing more favorable to the retention of the Chemical Warfare Service as a unit of the army and toward continued research in gas warfare. The accompanying editorial, published in a recent issue of the *Chicago Tribune*, expresses civil opinion more strongly than I have yet heard it in private conversation or seen it in the public print, outside of your own magazine.

#### Chemical Warfare

One of the Washington agreements outlawed gas and chemical warfare. The United States has ratified it and other agreements. The other nations have not ratified and the American War Department reports that many of the others, including Great Britain, are pressing active investigations of gas weapons.

Great Britain was in favor of prohibition. The British have two fears. One is fear of the use of gas against London and other centers of congestion and production on the island. The other is fear of the submarine against British commerce. Both the gas and the submarine prohibitions worked into the Washington agreements are believed to represent Great Britain's price for agreeing to American proposals.

American civilian sentiment opposes both gas and submarines, and opinion is not based upon reason or prospects, but upon innate abhorrence of war, particularly when it strikes the imagination as cruel and unusual. The *Tribune* believes that the prohibitions which this sentiment indorsed were unwise and detrimental to the United States.

The activity of the other nations, including the British, indicates that in no other country will there be any letup in research and preparedness in chemical warfare. Americans probably will know as little as possible about it, but the others, even promising not to use gas, will be experts in the offensive and defensive of chemical war.

That is our loss and may be our danger. Warfare which depends upon the industries, the laboratories and the science of a nation may be the protection of peaceable, industrial people. It is part of the supremacy of a high civilization over a low civilization.

All explosive shells release lethal gasses. Men in

dugouts are killed by fumes, although not reached by the explosive force. Evasions of the stipulated prohibition are easy and it is a reasonable probability if not a certainty that a nation which could save itself by the use of gas would not hesitate to use it.

When men in peace and security attempt to bind men in peril and desperation they frequently fail. War is the business of overcoming an enemy's resistance and the accomplishment of a purpose by force. It is not a game. It is not undertaken in the spirit of sport. People who are fortunate do not have to undertake it at all.

When they do they will not say that they will not use a weapon with which, if they used it, they might save themselves. If a British commander, attacked by thousands of dervishes, could save his command and disperse the enemy by use of a lethal gas, he would be inhuman if he did not do so.

The sentiment against gas reveals one of the taboos of the sentimental mind and does not proceed from its reasoning.

Congress will be well advised to continue the Chemical Warfare Service and to provide adequate appropriation for research.

C. W.

New York City.

### An Outline of the Uses of Lime

To the Editor of Chemical & Metallurgical Engineering

SIR:—Referring to Mr. Holmes' reply<sup>1</sup> to my criticism of his article,<sup>2</sup> I cannot see the connection between his second statement and the original.

The original read: "There are three kinds of stucco—viz., straight lime and gaged stucco and sorrel (*sic!*) cement. In the first two, lime serves as a bonding agent, plasticizing agent, toughening agent and water-tightening agent. In sorrel cement the action of lime is primarily chemical instead of physical."

The reply states: "The use for lime that we had in mind for the manufacture of sorrel cement was not the addition of lime to the cement, but the use of a dolomitic lime as the base for the cement. . . . The process . . . consists of burning dolomitic lime at a temperature at which the calcium carbonate is not decomposed."

Leaving out an apparent confusion of the terms "lime" and "limestone" in Mr. Holmes' communication, I am unable to see, if the calcium carbonate is not decomposed and hence is inert, how its action can be primarily chemical. Moreover, if the calcium carbonate is not decomposed, this is not a "use of lime"; the calcium carbonate is a mere inert filler, equivalent to sand. It is a use of dolomitic limestone for the magnesia content.

On the other hand, if the original paper is correct in stating the action is primarily chemical, how is this gained by leaving the calcium carbonate undecomposed?

DONALD M. LIDDELL.

New York.

### Magnesite in 1921

Reports received by the United States Geological Survey, Department of the Interior, from producers of magnesite show that the quantity of crude magnesite sold or treated during the calendar year 1921 was 47,904 short tons, valued at the mines at \$510,177. This quantity was less than half that for the year 1920, and smaller than that for any year since 1916. California was the only producing State, and nearly all the product was calcined for use as plastic material. The output of domestic magnesite for use in refractory products was very small.

<sup>1</sup>April 5, 1922.

<sup>2</sup>Feb. 15, 1922.

## An Informational Service For a Chemical Manufacturing Concern

BY D. B. KEYES

U. S. Industrial Alcohol Co.

**T**HE growth of the chemical industry in the United States for many years was slow and faltering. It was not until the outbreak of the war that the rapid expansion of this industry required the compilation and accumulation of technical information on an unprecedented scale, as concerns both the vast amount of data to be collected and the rate at which its compilation had to proceed. In many of the larger chemical firms whole departments were devoted exclusively to informational service, and the work was carried out systematically and efficiently in order that no time might be lost in bringing the new American industry up to the standard set by its older foreign rivals.

In the present discussion the writer wishes to bring attention in a practical way to those vital points involved in the organization and maintenance of such an informational department which would be of most interest to the executive head of a chemical manufacturing concern. First, then, let us consider the nature of the demand the informational service must supply.

### WHO ASKS QUESTIONS, AND WHAT DO THEY WANT TO KNOW?

Nine hundred and ninety-nine men out of a thousand would prefer to ask a question than to reason it out for themselves, or to look it up. If an information department acquires the reputation of answering quickly and correctly all questions asked of it, it will be besieged by every person connected with the company, from the fastidious office boy who wishes to remove egg from his necktie, to the member of the board of directors who would like to know the technical soundness of a new process in which he wishes to invest.

A brief outline is given below of some of the important departments in a chemical concern and the sort of information that each is most likely to desire.

#### The Research Department:

##### Properties of substances:

- Physical.
- Chemical.
- Physiological.

##### Processes:

- Laboratory preparations.
- Manufacturing processes.
- Recovery processes.

##### Analytical methods:

- Qualitative.
- Quantitative.

##### Specifications for products.

##### Uses of products:

- Kind of use.
- Extent of use.
- Details of consuming processes.
- Laws governing use.

##### Economic data:

- Prices.
- Consumption statistics.
- Production statistics.
- Imports and exports.

- Recommendations concerning past and future research.
- Recommendations received from customers concerning development of new products.

**How a Special Department Devoted Exclusively to the Accumulation of Technical, Economic and Legal Information Can Serve the Executive, Research and Other Departments Within a Manufacturing Organization in the Chemical Industry—Details of Organization, Operation and Cost**

#### The Sales and Advertising Departments:

- Properties of products.
- Specifications for products.
- Methods of analysis of products.
- Uses of products.
- General market conditions.
- Technical sales articles.
- Technical talking points for products.
- Characteristics of competing products.
- Recommendations concerning minor difficulties experienced by consumers.

#### The Patent Department:

- Literature searches.
- Technical aid in drawing up applications.
- Technical aid during any patent litigation.
- Collecting evidence regarding inventorship.
- Collecting data needed in case of interference or infringement.

#### The General Legal Department:

- Technical aid in damage suits.
- Expert technical witnesses.

#### The Auditing Department:

- Cost estimates when special knowledge is necessary.

#### The Traffic Department:

- Properties of products:
  - Physical.
  - Corrosive.
  - Explosive.
  - Physiological.
  - Flammability.
- Kind of shipping container for special products.
- Traffic regulations concerning products and materials.

#### The Purchasing Department:

- Properties of substances purchased.
- Specifications of substances purchased.
- Sources for—
  - Raw materials.
  - Supplies.
  - Equipment.
- Price fluctuations:
  - Past.
  - Future.
- General market conditions.

#### The Plant Executives:

- Process efficiencies.
- General market conditions.

#### The Company Executives:

- Control of outside consulting men hired by the company.
- Summaries and criticism of work done by the research department.
- Detailed information regarding issued patents and patent applications owned by the company.
- Recommendations regarding future research and development work.
- Recommendations regarding processes offered to the company by outsiders.
- Recommendations regarding new sales fields for products.

### HOW THIS INFORMATION CAN BE OBTAINED

A great many articles have been written in recent years on the subject of making literature searches. These have been written by competent men, but usually from widely different viewpoints. Probably the best scheme for a particular purpose is the one that is worked out by the searcher himself. The characteristics most desired in the searcher therefore are ability to solve and tenacity to stick with the puzzling technical problems.



U. S. No. 1,405,183		<b>G 1</b>	
Date Jan. 31, 1922		Inventor Burgess, L.	
Date Filed May 13, 1919		Subject Production of Anhydrous Aluminum Chloride	
Serial No. 396,793		Class Chloride	
Address Off. Cas. 224, 903		Applicant Standard Oil Co. of New Jersey	
(1922)		Place of Invention New York, N. Y.	
<p>3. The process of producing anhydrous aluminum chloride, which consists in continuously feeding finely divided aluminum carbide into a current of hydrochloric acid gas, mixing the said gas and aluminum carbide by agitation, passing the mixture into a reaction chamber, and initiating a reaction in said chamber by application of heat.</p>			

Zeit. Elektrochem. 27, 563-7		<b>A 4</b>	
(1921)		Author Keller, Erich	
Chem. Abs. 15, 1078 (1922)		Subject Dehydroxidation of Alcohols	
<p>A large number of alcohols when dissolved in concd. alkali evolve H or hydrocarbons during electrochem oxidation. This behavior, which is similar to that due to the catalytic action of Rh, is explained on the assumption that in the oxidation of alcohol to aldehyde a metastable alcohol is formed as an intermediate product, which either alone, or in the presence of a catalyzing metal, decomps. with evolution H.</p>			

FIGS. 1 AND 2—TYPICAL AUTHOR CARDS FROM THE INFORMATION DEPARTMENT FILES

It would, perhaps, be futile to outline a definite system for searching the technical literature. Sooner or later even the most brilliantly conceived systems are bound to fail. However, a few general observations may be of interest in this connection.

The number of periodicals to be looked over regularly may be quite variable. Certainly the abstract journals such as the *American Chemical Abstracts*, the abstract sections of the *Journal of the Chemical Society* (London) and the *Journal of the Society of Chemical Industry* and the *Zentralblatt* must be consulted. The leading American chemical publications, including both technical and trade papers, as well as all publications applying directly to the particular field in which the company is operating, must be considered as necessary adjuncts. The *U. S. Official Patent Gazette* is always found valuable and interesting.

In the particular informational department on which this discussion is based, a number of good reference books were obtained, but it was not found desirable to purchase any book that was to be used but rarely and could be consulted at some convenient library.

The information department was thoroughly acquainted with every library in the vicinity and knew approximately what books and periodicals each contained. These libraries were consulted not only for special literature searches but also for interesting current, foreign and domestic publications, whenever these publications were not available at the offices of the department.

Societies which were related to the particular industry often held conventions at which technical problems were discussed and suggestions made or facts stated that would be of value to the company. These conventions were usually attended by at least one member of the information department.

No sources of information should be overlooked or forgotten. On the other hand, the list of sources should be constantly increased and the potential value of each recognized and appreciated. In other words, the scope of the information service must be constantly expanding in order to serve its needs most efficiently.

#### HOW INFORMATION SHOULD BE FILED

There is vast difference between storing information and filing information. Treasures buried in an unknown spot may be quite safe, but treasures locked in a safe deposit box have many very practical advantages.

It is no easy task to file technical information efficiently. Evidence of this can be seen in any large library. Very little has been done in cataloging except by authors and titles. Perfection cannot be obtained in a subject file, except at an excessive cost. A work-

able system can be made, however, by holding to a simple outline, such as one which has been evolved after years of development.

The first principle to be adhered to by the informational department was to have an abstract of *all* information on a card that was filed by authors. These cards are more important than any of the others and therefore were the largest in size. Logically they were filed by authors, because each article or piece of information had one distinctive author while at the same time it might have covered many important subjects. No large technical file, classified by subjects, was ever found to be entirely practical.

Several small subject cards were made for each author card; these subject cards were filed separately and used only to locate the author card when the author was unknown.

#### THE AUTHOR CARD

The author cards were of two kinds, those that cover patents and those that cover articles. These cards were not kept in one file, but were divided up into separate files, each covering some field important to the company. The simplest classification was according to products, but other important subjects could be entered such as chemical apparatus, solvents, engineering materials, etc., depending entirely on the particular industry. It was found best to make the product classifications as general as possible—for example, group references to acids, bases, alcohols, aldehydes, esters and ketones. In the case of some other industry such as the dye industry still other broad classifications may be used.

The details of the author card are best seen by studying the examples given in Figs. 1 and 2. It will be noticed that a file letter and number appear at the top of the card. The letter refers to the particular file in which the author card was placed, and the number refers to the card's position among the other cards by the same author. These cross-references on the ordinary author cards referring to articles, and on the author cards covering patents, have been found to be sufficient for all practical purposes. The file letter and author number were easily put on with a rubber stamp; the remainder of the items, including the abstract, were generally typewritten. If for any reason the front and back of a card were not sufficient for the abstract, a double card was used which folds once, giving the same over-all dimensions. An excellent method sometimes used to save time in making these cards was to paste on the clipping itself. This was especially true in the case of making cards of abstracts appearing in abstract journals. The cost of extra magazine sub-

scriptions was small compared with cost of the stenographic work.

#### THE SUBJECT CARD

The subject cards, illustrated in Fig. 3, are much smaller than the author cards and served only as a subject index for the author cards. It was quite possible for one subject card to refer to more than one author card and therefore have more than one set of file letters and numbers.

The making of useful subject cards is an art and not a science. It was found desirable to have one person make all of the subject cards, because any radical change in the system was fatal to the usefulness of the file. A common-sense basis was decided upon at the start and strictly adhered to thereafter. This system is outlined below:

The wording of the subject appearing on the subject card was divided into four groups. *First* was the "Classification Group," which gave the general class under which the subject belongs; usually there was a separate author-card file for the particular classification group. *Second* was the "Title Group," which gave the name of the individual substance, product or chemical, apparatus, etc., to which the information referred. *Third* was the "General Modification Group," which included statements such as "Manufacture of," or "Chemical Properties of," or "Use of." *Fourth* was the "Special Modification Group," which included all other subdivisions or modifications of the subject. This group naturally had a very wide range—for example, "from molasses," "vapor pressures," etc.

Some of the subjects on the subject cards would have appeared, if divided into groups, something like the following:

Esters		Ethyl Acetate		Physical Properties of		_____	
1		2		3			
				Boiling Point			
				4			
Acid Formic		Preparation of		_____		from Carbon Dioxide	
1		2		3		4	
Apparatus Filter		Use of		_____		to Clarify Cane Juice	
1		2		3		4	

The dash after group 3 was used to denote the direct relation of this group to the preceding one.

The "Classification Group" has already been said to have included all the headings that appeared as subjects of the separate author card files, and this group might also have contained other subjects that were not extensive enough at the moment to warrant a separate author card file. Examples of these subjects were: Acids, bases, esters, aldehydes, ketones, apparatus, engineering materials, etc.

The "Title Group" referred to the particular substance or thing; examples were: Formaldehyde, filter, acetone, amyl acetate, ethyl chloride, drier, etc.

When there were modifying words they were placed immediately after the class name—e.g., acetic *anhydride*, pumps *centrifugal*, etc. Although this group was necessarily very large, it was added to at will, but care was taken to prevent using more than one name for the same substance. When there was a choice between two or more names for a substance, the one that was standard in other chemical indexes was selected.

When a subject card was made, care was taken to look over both the title and the subject matter of the author card. Very often an author card was of importance to the company only because it contained information concerning one of the company's products and the name of this product did not appear in the title on the author card.

The "General Modification Group" classified the information that was given on the author card concerning the substance or thing mentioned in group 2.

FORM 48-100-11-21	
SUBJECT <u>Alcohols, Ethyl Alcohol, Chemical</u>	
Properties of -----; Dehydroxidation	
AUTHOR <u>Möller, Erich</u>	<b>A 4</b>
DATE <u>1921</u>	

FIG. 3—A SAMPLE SUBJECT CARD, WHICH IS AN INDEX FOR THE AUTHOR CARDS

This classification is best understood by looking over the following list of common subjects that appear in this group.

Physical Properties.	Properties that can be expressed by some numerical value.
Chemical Properties.	All types of reactions.
Preparation.	Laboratory methods but not commercial methods.
Manufacture.	Commercial and patented processes.
Use.	Any use that would be of commercial value.
Physiological Properties.	Data on toxicity. Any biological reaction.
Economic Data.	All data on trade and production, quantities and values.
Determination.	Quantitative.
Detection.	Qualitative.
Analysis.	For impurities.
Occurrence.	
Recovery.	
Purification.	Freeing from impurities.
Separation.	From other substances.
Concentration.	
Constituents.	Components of a mixture or a solution.
Specifications.	Requirements for various grades or mixtures.

The list of subjects was added to whenever it was deemed expedient, but it was thought best to keep this list as small as possible. In case the subject of this group 3 referred to the general class mentioned in the corresponding group 1, then group 2 was omitted. An illustration is:

Acids	Physical Properties of	Dissociation
1	3	4

The "Special Modification Group" represented a modification of the subject given in group 3. Not much attention was paid to this group, except to see that it was present and that it was short and "meaty." Ex-



amples of complete subjects containing this group, are given below:

Esters, Amyl Acetate, Use of —,  
as a solvent for pyroxylin

Aldehydes, formaldehyde, Preparation of —  
from carbon monoxide

As this was the last group and the one which covered the widest field of subjects, it was not considered necessary to make any particular classification.

Subject cards were filed alphabetically in the ordinary manner, but as many subdivision cards as possible were used to facilitate the filing and locating of a particular subject.

Both author card and subject card files were kept in duplicate—one complete file at the research laboratory and one in the information department. In the research laboratory the subject cards were always kept in the file in case any author card that may have been taken out and lost could be located in the information department's file and duplicated. Fire insurance was carried on these cards, the amount covering the cost of the copying.

#### OTHER FILES AND FORMS

All photostats and manuscripts such as translations, copies of odd journals, etc., were filed by author and had corresponding author and subject cards filed in their respective files. The author cards stated where the manuscript could be found. This manuscript file also contained all reports and any memoranda that were not made by the research staff.

Research or laboratory reports were filed separately and had a separate author- and subject-card system. These reports were also filed by author or by some very simple subject classification. The author card stated where the report might be found.

A patent specification file for all patents not owned by the company was arranged according to author. These, too, had corresponding author and subject cards in the main file. The author card stated where the specification might be found. The specifications of patents assigned to the company were conveniently kept in a note book form, one book for U. S. patents arranged alphabetically by countries. Data on applications filed in the United States by members of the company were kept in a loose-leaf notebook. The following information was included: Name of inventor, title, serial number, date of filing, abstract of subject matter; and later when the patents were issued, the numbers and dates of issue were added. Copies of applications and all legal papers connected with the cases were kept in folders and filed alphabetically by inventors. These folders did not need any corresponding author and subject cards.

Special forms were made up to cover all material required by the patent lawyers in order to make up an application. These forms were filled out by everyone connected with the invention. After the application was filed a special form of an affidavit was filled out by the inventor. This affidavit gave the data necessary in case of an infringement or an interference. Both of these papers were filed in the folders mentioned above.

The manuscript, report and patent specification files were kept in duplicate, one copy in the research department and one in the information department. It was found convenient in certain cases to have a third or fourth copy in other departments.

#### THE ORGANIZATION

An adequate organization for the average large chemical manufacturing concern would consist of a chief, two technical assistants and three stenographers.

The chief may be a consulting chemist or chemical engineer, who devotes only a part of his time to the information department, the rest of his time being used for consulting work on problems arising within the company. This man must be thoroughly familiar with all of the company's problems and he should be able to foresee the difficulties, both technical and economic, that may arise in their consideration. In brief, he should be a capable chemist, engineer and business man.

The two assistants should be well-trained technical men, who are able to look at a problem from the economic viewpoint. Long experience is not essential. One should be well qualified to read technical French, German, Italian and Spanish. One should handle the routine work, but should be able to prepare an intelligent abstract of a technical article. Both should soon acquire knowledge of the whereabouts of all available sources of information. Naturally this knowledge increases steadily with time. One of the assistants should familiarize himself with the gathering of statistics.

Even the stenographers should comprehend the fundamental principles of chemistry. They must be able to take several hours of dictation covering some technical or scientific subject. Six to eight months is usually necessary to train the average stenographer to be efficient in such a position. Quite often a stenographer desires a special form of shorthand to cover the particular technical terms that occur many times in the work. In case the laboratory is not located in the same building as the information department, it may be desirable to have one of the stenographers stationed in the laboratory library to handle the routine of that department, such as the writing and filing of reports.

#### THE INFORMATIONAL SERVICE IN OPERATION

The current cards covering abstracts of interesting articles were sent daily to the director of the research department. Under ordinary conditions these amounted to about 200 a month and were taken from 60 to 100 publications issued during the same period. The subject cards for these author cards were filed at the laboratory and some of the author cards were sent by the director to various research men. The information department always filed their copies promptly and they were therefore immediately available to all who are interested in them.

Special cards covering more important subjects were sent to the research director marked for his special attention. Likewise photostats, reprints, special copies of periodicals and books were routed through the organization. These were always accompanied by author and subject cards for the research department's files.

Special reports and memoranda were usually sent to the person who made the request for the information and occasionally copies were sent to the general manager, the director of research or the sales manager, depending on the subject. Cards covering these reports were filed as stated previously.

There were many other special features that increased the speed and efficiency of the information service. Obviously only a few can be mentioned here.

One assistant spent most of his time in a large outside library where he could be easily reached by phone.

This library was equipped with a photostating service so that photostats of articles up to fifty pages in length could be obtained within 24 hours after the request was made.

The company's purchasing department was posted regarding all available sources for odd books and periodicals, but the actual subscriptions to periodicals were handled through the informational department.

The valuable services rendered by the office of the editor of *Chemical Abstracts* were utilized to good advantage. The Washington representative of the company's patent attorneys was called upon when photostats of foreign patent specifications were desired in a hurry.

The information department had numerous professional friends who were willing at all times to give bits of information and minor opinions in return for similar services.

The chief of the information department was in close touch with all research men employed by the company, in order to be qualified to judge the needs of the research department. Physically, it is easier to talk than it is to write or even to dictate; therefore frequent conferences with the research men were found to be unusually helpful. This was also true of conferences with the other departments.

After a large and exhaustive card file had been made up, difficulty was experienced in educating the men to make use of it. It happened on several occasions, however, that the basic principles and patentable ideas of some "invention" were found fully described on an information card. After this occurred, the "inventor" was usually more inclined to make use of the information file before starting work on his next idea.

#### THE COST OF THE INFORMATIONAL SERVICE

A statement of the average yearly cost of an information department is given below:

Salaries	
Chief (half time of a high grade consulting chemical engineer).....	\$4,000
Two technical assistants (\$3,000 each).....	6,000
Three stenographers, (average \$100 per month).....	3,600
Expense of trips (Depending on location of laboratory and information department)	600
Office rent (15,000 sq. ft., including libraries; \$3 per sq. ft.).....	4,500
Photostats.....	300
Periodicals.....	150
Books.....	250
Incidentals.....	100
Total.....	\$19,500

It is understood, of course, that the proposed department would be for a relatively large chemical manufacturing organization. The department and its cost would be proportionately smaller for a smaller company.

New York City, N. Y.

#### French Chemical Industry Improving

The heavy chemical industry of France is making rapid strides of improvement, according to Commercial Attaché D. C. Huntington, who writes from Paris on June 12. He reports that business is much better than a year ago and prices are well maintained. Chemicals for tanning, glassworks and paints, however, still remain inactive. Synthetic products for drugs and perfumes are satisfactory. The important chemical firm, *Etalissements Kuhlmann*, reported at the annual meeting that its plants now working at 85 per cent of capacity, as compared with an average of 50 per cent for 1921. This company has successfully made two wage reductions.

## Legal Notes

By WELLINGTON GUSTIN

### Eibel Patent for Improvement in Fourdrinier Machines Held Invalid and Not Infringed

In a long and well-considered opinion the United States Circuit Court of Appeals reversed the District Court, which had given a decree in favor of the Eibel Process Co. in its suit brought against the Minnesota & Ontario Paper Co. Suit was for infringement of the Eibel patent 845,222. The patent claims to be an "improvement in Fourdrinier machines."

The Fourdrinier has been the best known and most commonly used paper-making machine for generations. It consists, in its first section, of an endless wire sieve, passing over a series of rolls at a constant speed. At the wet or breast roll end of this running wire sieve there is discharged from a flow box through a sluice a stream of paper-making stock, consisting of wood pulp, sometimes with added mineral matter, mingled with from 135 to 200 times its weight in water. The stock has the appearance of diluted milk. The wire mesh over which the stock travels has also a sidewise shaking motion to assist in the proper fitting and interlocking of the fibers. The stock is carried along on this wire about 30 ft., draining off its water as it goes, until it reaches the couch rolls at the farther end of the wire, where it is pressed into the form of a uniformly distributed wet pulp or web strong enough to hold together. It is then carried through a series of pressing and drying rolls and calenders, which constitute the drying end of the machine. About 20 ft. from the breast roll are placed suction boxes in contact with the under surface of the wire operating by means of a partial vacuum to assist in the extraction of excess water remaining in the pulp and to compact the sheet by atmospheric pressure. This is but a meager description of the first part of a large and complicated machine upon which paper stock goes in highly diluted liquid form, is subjected to draining, shaking, meshing, pressing and heating processes, until it emerges as a smooth fabric newsprint.

#### NO VALID PATENT ON MERE PRINCIPLE

A Fourdrinier machine costs approximately \$100,000, and for economy is run continuously day and night. Speed and quality of paper have ever been the quest of paper makers. This is what the Eibel principle claims. But the court says of course there can be no valid patent on a mere principle. Claims 7 and 8 of the Eibel patent it holds void for lack of invention. Claims 1, 2, 3 and 12, if construed to cover any elevation of the breast roll of the paper-making wire appreciably greater than that shown by the prior art, to gain speed, the court says are void for indefiniteness and as differentiated from the prior art only by a mere change in degree. If construed in accordance with the natural import of the language, as requiring such a pitch of the paper-making wire as will alone, through gravity, without regard to the head in the flow box, bring about speed equality between the stock and the wire, and practically eliminate the drag of the wire, it discloses no useful invention, since no such pitch has even been used or claimed to be useful in practice.



## Modern Handling Methods in the Manufacture of Electrical Porcelain

BY GRAHAM L. MONTGOMERY

Electrical Porcelain Plant of the Square D Co. — Experience Obtained in Metal Working Applied to the Manufacture of Porcelain — Economies Realized Through the New Methods

**T**HE Square D Co. manufactures electrical safety devices, such as switches, panel boxes, and so on. A large amount of porcelain enters into these devices for purposes of insulation. Originally all this porcelain was purchased from outside manufacturers. This had the advantage of relieving the Square D Co. of the burden and responsibility of running a porcelain plant. On the other hand, it was attended with many disadvantages, such as inadequate supply, delay in deliveries and high costs.

In consequence, shortly after the armistice, the Square D Co. purchased the plant of the Peru Electrical Porcelain Co., in Peru, Ind. This was rather an old plant and perhaps not in the best of condition. But it was fully capable of turning out high-class product. The methods used there were those still generally used in similar plants and did not include any of the more recently developed equipment, such as tunnel kilns and continuous driers.

### APPLICATION OF METHODS FROM METAL-WORKING

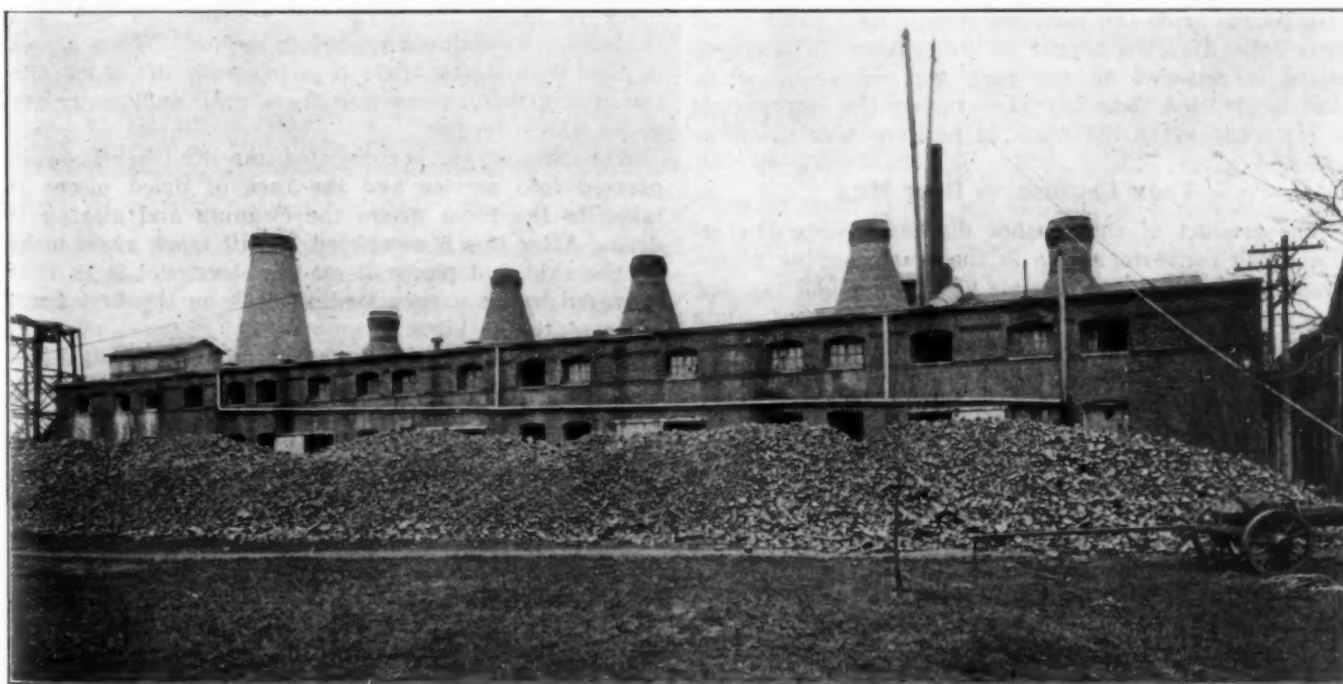
After the purchase of this plant a study was made of the equipment available for porcelain manufacture and of the methods generally used in such manufacture. It was found that the new plant was well up to the standard and the only improvements in methods that could be made would be by using the tunnel kilns or other equipment mentioned above. This equipment is expensive and the plant as then existing did not warrant such an expenditure.

The new owners were men experienced in the methods used in metal-working plants. It was immediately evident to them from their study of porcelain manufacture that there were possibilities of effecting economy and increased output if the methods of material handling with which they were familiar were applied to their new venture. Nothing was discovered along this line in other porcelain plants except in some few cases where conveyors were used for handling the raw clay as it was unloaded from cars.

### WHERE HANDLING EQUIPMENT WAS USED

Bringing their past experience of handling methods to bear in a study of the existing routine of manufacture at Peru, the works engineering department from the main plant in Detroit discovered many opportunities for economy and increased output. From the filter presses onward to the shipping room a complete handling system was devised which was inexpensive to install and which necessitated but little change in the existing manufacturing equipment.

For unloading the raw clay from the cars and for handling to and away from the blungers, methods were used which were in the main the same as are in use in many other plants. The handling used throughout the rest of the manufacturing process naturally falls into four main divisions. These are: First, handling the filter press cakes into and out of the drier and to the crusher. Second, handling the clay through crusher, tempering bed, dust mill and screen. Third, handling



KILN BUILDING, SQUARE D CO., PORCELAIN PLANT, PERU, IND.

the dust to the press room and the unfired products of the presses into and out of the drier and to the saggers. Fourth, handling saggers to the kilns, out of the kilns, and to the packing room.

#### TYPES OF HANDLING EQUIPMENT USED

The types of handling equipment which were found to be best adapted for use in porcelain manufacture were the hand lift truck, the belt conveyor and the gravity conveyor.

The hand lift trucks are used for handling filter cakes, for handling steel cars of dust, for handling the unfired product of the presses into and out of storage. The skids used for these lift trucks are of two types. Those for handling and storing bulky materials are with removable containers which may be locked to the skid and which can be built up to any desired height. Those for handling the product of the presses and the filters have racks attached. These racks consist of two uprights, fastened along the longitudinal center line of the skid with twelve horizontal supports of  $\frac{3}{4}$ -in. pipe on each side.

This total equipment consists of eight lift trucks and about 600 skids and racks. The method in which these trucks and the belt and gravity conveyors are used is described below.

#### HANDLING CAKES FROM THE FILTER PRESSES

By the usual method, the cakes from the filter press are carried into the drying room by hand, placed on horizontal stationary shelves, and when the drying is completed, carried out again and to the crusher. The new way utilizes the skids, which are provided with racks. With twelve supports on each side of these racks, twenty-four removable shelves or boards can be laid on each rack. The filter cakes are laid on these boards as they come from the press.

As soon as the shelves of a rack are completely filled, that skid is picked up on a lift truck and conveyed into the drier. When the drying is completed, the lift truck takes the skid to the crusher, beside which it is allowed to rest. As the workman operating the crusher desires to feed it, he takes one of the removable boards from the rack and dumps its load of dried filter cakes into the hopper of the crusher. The empty board is replaced on the rack and when the whole load is emptied thus into the crusher the empty rack is replaced by the lift truck in position near the filter press.

#### FROM CRUSHER TO DUST MILL

The product of the crusher discharges into the inclined belt conveyor shown in the accompanying photograph. This conveyor consists of a simple belt running in a wooden trough and inclined about 45 degrees. Slats are secured to this belt at close intervals to aid in carrying the crushed clay up the incline. At the top of its run this belt discharges into a swinging metal spout, by means of which the clay can be placed in any one of the several tempering bins as desired.

From the tempering bins the clay is shoveled onto the horizontal flat-belt conveyor which feeds the dust mill. This conveyor, also shown in the photograph, runs in a wooden trough and is provided near its discharge with a toothed wheel which serves to break up any lumps and thus prevent clogging of the dust mill.

In the dust mill the clay is ground to a fine powder. Referring again to the illustration mentioned above, a wooden housing will be seen at the left. This con-

tains the revolving screen, so placed that the steel cans used to hold the screened dust can be wheeled under it by the lift trucks and left standing there. The photograph shows a wooden chute leading from the dust mill into the wooden housing. The centrifugal force developed in the mill throws the dust through this chute into the screen. The screen is tilted, with its lower end at the point where the dust enters. The driest dust, being lightest, is thrown to the high end. In this manner the dust is separated into four general grades corresponding to the four meshes of the screen and roughly in accordance with the degree of moistness. As the screen revolves these grades sift through its meshes into cans waiting below. The rejects roll back and out of the screen at its low end to be put back through the process or discarded, as the case may be.

When a can is filled it is taken by a lift truck to the elevator. The elevator takes the can—on its skid—to the second floor, where the press room is located. Here another lift truck picks it up and places it conveniently for the worker at one of the presses, it being removed at the same time from the skid, which is taken back for another load.

#### A SPECIAL TYPE OF HAND TRUCK FOR DUST CANS

Recently a new method of handling the dust cans has been developed. The cans were provided with trunnions, placed near the tops so that they could be easily swung. Two special hand lift trucks were provided, one for each floor, built to engage these trunnions, lift the cans clear of the floor, and then transport them to the desired point. This is an improvement over the skid method, as the can had to be lifted by hand on and off of the skids, which took some little time and labor—now eliminated.

#### HANDLING FROM THE PRESSES THROUGH THE DRIERS TO THE SAGGER LOADING DOCK

As the unfired pieces leave the presses the press operator places them on a tray which rests on the table at the left side of his machine. Reference to the accompanying photograph will show the arrangement of dust cans, presses, trays and rack skids. The trays are made to fit on the horizontal supports of the rack skids as described in a preceding section. When a rack is filled with loaded trays it is taken by lift truck into the drying room, remaining there until sufficiently dry to be safely fired.

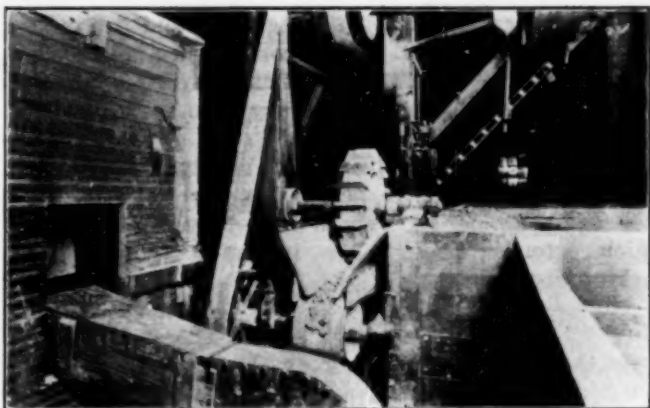
When the drying is completed, the lift truck is again pressed into service and the rack of dried pieces is taken to the room where the cleaning and glazing is done. After this is completed the lift truck again picks up the skid and places it on the elevator. It is thus conveyed to the sagger loading dock on the first floor, adjacent to the kilns.

In the illustration which shows the press room, it will be noted that some of the racks are on wheeled platforms. This method of handling was formerly used; but the lift truck method has proved to be quicker, cheaper and more flexible.

#### HANDLING SYSTEM FOR SAGGERS

Due to the large variety of shapes and sizes comprised in the product of the plant, there are twelve different types of saggers in use. For this reason it is necessary to have a large number in storage. The size of the storage thus needed has made it necessary for the saggers to be stored some distance away from this sagger loading department.

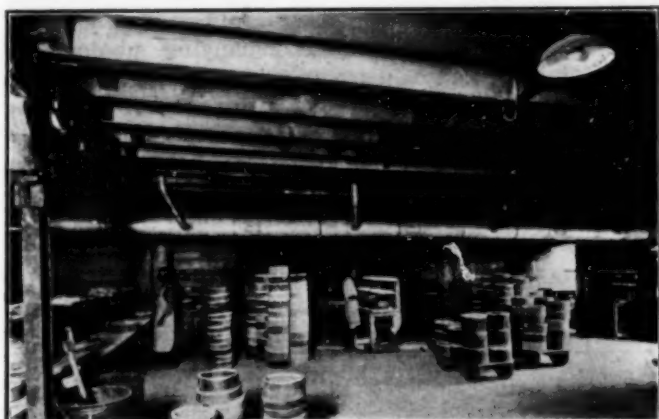




CLAY CONVEYORS, DUST MILL AND SCREEN HOUSE



PRESS ROOM



SAGGER LOADING DOCK



LOADING SAGGERS INTO KILNS BY CONVEYOR



CONVEYOR UNLOADING KILN AFTER FIRING

A plain, flat skid is taken into the sagger storage and the saggers desired are placed on this and taken to the sagger loading dock, where they are placed conveniently for the workers whose duty it is to pack the unfired ware in them. After the firing is completed, the sagger filled with ware is moved to the packing department and the ware taken out. The empty saggers are placed on a flat skid and taken by lift truck back to the sagger storage, where they are unloaded and stacked by hand until again needed.

#### LOADING THE SAGGERS

In the illustration which shows the sagger loading dock will be seen several of the loading benches. These benches are provided with shelves at the top on which are placed trays of the unfired ware. A skid rack of these trays placed close to the bench and a skid loaded with the appropriate style of sagger is placed at the



INSPECTING, CHECKING AND PACKING DEPARTMENT

end of the bench. The worker then packs the ware into the saggers, stacking the filled saggers close to the conveyor which leads to the kilns.

The most important part of the conveying system is that part which loads and unloads the kilns. The success of its operation depends entirely upon the manner in which the ware is packed in the saggers. Each piece must be so placed that it cannot knock against the next piece or the sides or bottom of the sagger; and it must be braced in position so that it will keep its place.

The conveyor used for kiln loading is also used for unloading, the top strand carrying ware to the kilns and the bottom strand carrying it away. This conveyor is made up of a two-decked roller conveyor with 16-in. rolls spaced 4 in. apart on the upper deck and 8 in. apart on the lower deck. Running over this roll is a flat canvas belt of heavy construction—14 in. wide.

This use of closely spaced rollers and a flat belt provides a bed on which the loaded saggers ride smoothly and evenly when the belt moves slowly, at about 25 to 30 ft. per minute.

The conveyor is 180 ft. from center to center of pulleys and passes directly by and about 8 ft. away from the loading and unloading doors of the six kilns. At the loading dock, the worker places a wooden pallet on the belt and on this pallet places a loaded sagger. This is repeated rapidly enough so that the spaces between the saggers are about 4 ft., care being taken that these spaces shall not be less. At the speed which this conveyor travels, this gives a delivery of loaded saggers to the kiln equaling about 400 per hour.

#### HOW THE SAGGERS ARE CONVEYED INTO THE KILNS

The chief difficulty encountered in laying out this system was to devise a workable means for automatically taking the loaded saggers from the main belt onto an auxiliary belt traveling at right angles and taking the saggers into the kiln. It is necessary to make this transfer in such a way that the sagger is not disturbed sufficiently to tip or break the unfired ware.

The method adopted to accomplish the transfer is ingenious but simple. Directly opposite the door of each kiln is a section of the roll conveyor bed of the main belt which is removable. A portable belt conveyor is used as the connecting link between the main belt and the kiln. On the end of this which is toward the main belt two ball-bearing rollers are mounted beneath the frame with their axes of rotation parallel to the line of travel of the portable belt. These rollers are exactly similar to those forming the bed for the main belt.

The removable part of the main belt bed—which corresponds in length to the width of the portable belt frame—is removed. The end of the portable belt carrying the two rollers is then pressed down into this opening and bolted in place. The two rollers serve to guide the main belt around and below the portable belt. When this is completed, the portable belt is running at a level slightly below the general level of the main belt and at right angles. Its other end extends into the kiln—where it delivers onto a short section of roller conveyor which serves as a collecting place for saggers until the kiln-loading crew can dispose of them.

At the corner between the two belts a snub wheel will be noticed. When a sagger comes along the main belt it travels out over the portable belt until it tips through its own weight. The motion of the portable belt pulls it over until it comes against the snub wheel. This serves as a guide and it travels smoothly around the corner and into the kiln.

#### UNLOADING THE KILNS

For unloading the kilns, a portable gravity conveyor is used. This extends from inside the kiln to the return or bottom strand of the main belt conveyor. The portion next to the main belt curves through 90 degrees and thus delivers in the same direction as the main belt travels. This will be seen in the accompanying photograph.

The method of attaching the portable gravity to the main belt is very ingenious. The last roller is removable. This is removed and slipped under the belt, and then put back and bolted in place with the belt over it. When the frame of the gravity is bolted to the main belt this serves to press the belt against the under

side of the second roller on the gravity and revolves it in a reverse direction. As a consequence, the loaded saggers, as the pallets which they travel on hit this roll, are slowed up and come easily onto the main belt.

After passing this point, the loaded saggers travel on the main belt to a point just short of the sagger loading dock. Here the belt makes a vertical dip and the saggers slide off onto a gravity roller conveyor which extends through the inspection, sorting and packing room.

#### INSPECTING AND PACKING

As the saggers pass along on this gravity conveyor the inspectors sort them and throw out the damaged pieces. The proportion of waste is carefully counted. The saggers then pass on to the packing department, in which location the conveyor is horizontal and they slow up enough for the packers to remove the good ware and pack it. The accompanying photograph clearly shows how this department is arranged. Pallets, saggers and cartons of finished ware are all taken on skids and lift trucks to their various destinations.

This system has accomplished three advantages as follows: 1. It has reduced the manufacturing cost for the product. 2. It has reduced the labor force necessary. 3. It has materially increased the output. All the above has been achieved with an expenditure of less than \$10,000 on handling equipment.

#### SOME ECONOMIES REALIZED

Formerly in loading a kiln ten men were required for 20 hours—a total of 200 man-hours. With the conveyors two men are required in the kiln and three men to load saggers at the dock for a total of 7 to 8 hours, or 40 man-hours. This is a clear saving of 80 per cent in this, the most costly labor operation in the plant.

Formerly in unloading a kiln the saggers were carried out by hand, their contents dumped into a tote box and then this carried to the inspecting and packing department. This method took five men working 20 hours, or 100 man-hours. The new method takes six men 8 hours, or 48 man-hours. This is a clear saving of 50 per cent of the labor cost on this operation. In addition, far more breakage occurred in the old method of handling than now occurs throughout the process.

The management stated to the writer that through the use of the conveyor which loads and unloads the kilns a net saving in labor and burden amounting to \$125 per day is realized. As the interest charges on the total handling system are not over \$50 per month and the operating, maintenance and depreciation charges are very low, the saving effected is really amazing.

A study of the savings resulting from the use of the skids and racks with the lift trucks has not as yet been made; but it is evident to the management that they obtained many advantages through this equipment. One of the outstanding advantages realized is a reduction—in the proportion of 1 to 20—in the time a man has to be in the hot atmosphere of the drying rooms and also in the time which the drying room doors have to be open with consequent loss of heat.

The writer wishes to acknowledge his debt to the management of the Square D Co. both in Peru and in Detroit and to the Dow Co., of Louisville, Ky., which made most of the conveyors described, for their kindness in making available the data of this article.



The temperature drop from the steam to the outer surface of the pipe depends upon the resistance to heat flow offered by the film at the inner surface and the resistance offered by the iron wall of the pipe. No attempt was made to measure this temperature drop in the present investigation, as it was considered to be so small as to be negligible.

The temperature drop from the outer surface of the pipe to the inner surface of the covering for 1-in., 3-in. and 10-in. pipe is shown in Fig. 2. These curves show that the temperature drop increases as the pipe diameter decreases. A test was also made on a 3-in. pipe with an air space of 1.2 in. between the surface of the pipe and the insulation. By comparing this curve with the curve for an air space of 0.1 in., it is observed that the temperature drop for a 1.2-in. air space is only a few degrees more than for an air space of 0.1 in. This is probably due to the fact that for air spaces much greater than 0.2 in. convection currents are increased, thus causing an increase in heat loss. An examination of Fig. 2 shows that the temperature drop for a 0.1-in. air space is approximately equal to that for 0.1 in. of commercial insulation, so that this temperature drop can be neglected in calculations and the pipe covering considered as fitting close to the pipe with the pipe temperature and the temperature at the outer surface of the covering as the temperatures bounding the covering.

The drop in temperature, or the temperature gradient curve through the insulation, depends upon the thickness of the covering and the curvature. In a cylindrical covering the resistance to heat flow dimin-

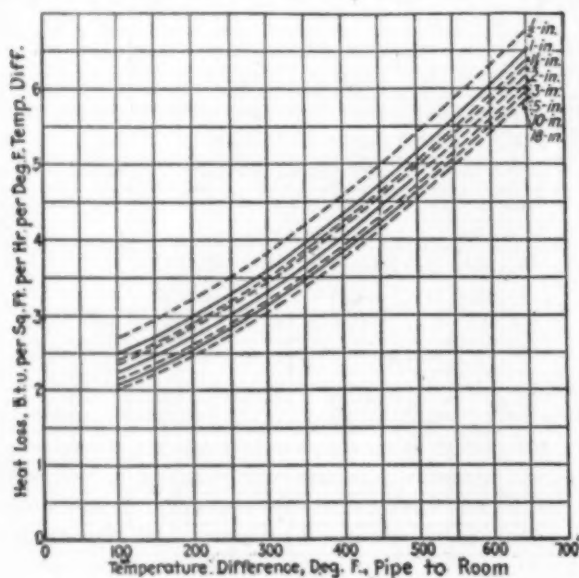


FIG. 1

ishes as the outer surface is approached, the temperature drop becomes less, and the gradient curve is bowed downward if the curvature alone is taken into consideration. However, the absolute conductivity decreases as the outer surface is neared, with a consequent bowing up of the gradient curve, and the two tend to counteract each other, so that the temperature gradient curve may be bowed either up or down or be a straight line, depending upon the curvature of the cylinder. The temperature gradient curve for a flat surface should bow up.

It is highly desirable that tests should be conducted on commercial steam pipe coverings of different thicknesses and at different temperatures, in order to obtain mean absolute conductivity curves for the different thicknesses.

The temperature drop from the outer surface of the insulation to the surrounding air depends upon the amount of heat emitted by radiation and air contact. This in turn is dependent upon the nature of the sur-

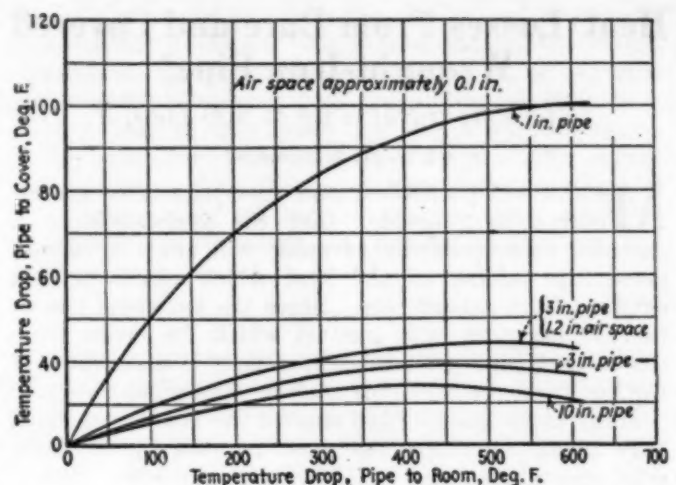


FIG. 2

face of the body, the shape of the body, the excess of its temperature over that of objects to which radiation takes place, and the absolute value of the temperature of these bodies. Commercial steam pipe coverings are invariably covered with a canvas jacket. From the above mentioned facts it is obvious that the loss from a canvas surface at a given temperature is independent of what is under the canvas, so that, if the canvas-loss law can be ascertained, this law may be applied to the loss from steam pipe coverings and thus the temperature of the outer surface of the insulation can be determined. In making calculations of heat loss through an insulation, it is absolutely necessary to know the temperatures at the inner and outer surfaces.

Péclet made a careful study of the heat emissivity from various surfaces, canvas surfaces included. As mentioned, however, his experiments were conducted at relatively low temperature. McMillan<sup>2</sup> made a study of the heat emissivity from a canvas surface in his study of commercial steam pipe coverings, but confined his experiments to one pipe size only. Nevertheless, McMillan's results in the form of a curve present a readier means of calculating the losses from steam pipe coverings than do Péclet's, whose observations, while taking all the variables into consideration, are in too complicated a form to provide a ready means of calculation.

Since McMillan's canvas-surface-loss curve was obtained from experiments on one pipe size only, this curve can be used in making calculations on coverings of a diameter approximately the diameter of the cover-

<sup>2</sup>Trans., A.S.M.E., vol. 37, p. 928.

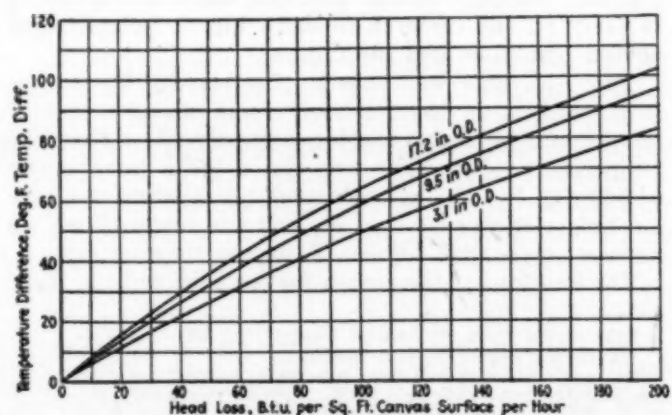


FIG. 3



ings tested. In order to be able to calculate the loss of heat from pipe coverings of any diameter, it has been necessary to obtain the canvas-surface-loss curves for various diameters. Accordingly, coverings were tested on the 1-in., 3-in. and 10-in. pipes used in determining the bare-pipe losses. The average outer diameters of the coverings used were 3.1 in., 9.5 in. and 17.2 in. The results of these tests are shown in Fig. 3.

In order to simplify the calculations necessary to determine the loss of heat through coverings of various diameters, an equation for the three curves shown in Fig. 3 has been derived. In this equation

$$T_d = \frac{272.5 h}{h + \frac{564}{D^{0.18}}} \quad (1)$$

$T_d$  = temperature difference between canvas surface and room, deg. F.

$h$  = total B.t.u. loss per hour per square foot of canvas surface.

$D$  = outer surface diameter, inches.

This equation is approximately accurate for diameters up to 2 ft.

Thermocouples were used in determining the canvas temperatures. During this investigation it was found that the couple, when just inserted under the canvas, would invariably read low. This difficulty was overcome by inserting it under the canvas for a distance of several inches, this distance depending upon the size of the couple and the temperature of the covering.

A covering 2 in. thick, having a mean absolute conductivity coefficient of 0.56, is placed on a 4½-in. outside diameter pipe maintained at a temperature of 400 deg. F. The temperature of the surrounding air is 700 deg. F. Determine the heat flow  $H$  in B.t.u. per hour per sq.ft. of pipe surface.

The heat flow through a cylinder is given by the following equation:

$$h = \frac{K(T_1 - T_2)}{r_1 \log_e \frac{r_2}{r_1}} \quad (2)$$

where  $T_2$  is the temperature at the outer surface of the covering. To obtain  $T_2$ , knowing only  $T_1$ , the pipe temperature, and  $T_d$ , the room temperature, it is necessary to change the form of the equation so as to include  $T_d$ , thus:

$$h = \frac{K(T_1 - T_2 - T_d)}{r_2 \log_e \frac{r_2}{r_1}} \quad (3)$$

in which

$K$  = mean absolute conductivity of insulation.

$r_1$  = radius of inner surface of insulation, inches.

$r_2$  = radius of outer surface of insulation, inches.

$T_d$  = value given by equation 1.

Substituting in equation 3, there results

$$\begin{aligned} h &= 0.56 \left[ \frac{400 - 70 - \frac{272.5 h}{h + \frac{564}{8.5^{0.18}}}}{4.25 \log_e \frac{4.25}{2.25}} \right] \\ &= 0.207 \left( 330 - \frac{272.5 h}{h + 375} \right) \\ &= \frac{-\sqrt{363.1} = 363.1' + 4 \times 25,600}{2} = 60.4 \end{aligned}$$

whence  $H = 60.4 \times \frac{4.25}{2.25} = 114$  B.t.u. loss per sq.ft. of pipe surface.

The temperature of the outer surface of the covering can be obtained by substituting the value  $h$  in the equation  $T_d = 272.5h/(h + 375)$ , reducing to  $T_d = 37.6$ . Therefore the temperature of the outer surface of the covering is

$$37.6 + 70 = 107.6 \text{ deg. F.}$$

The utility of these equations will be apparent to anyone who has occasion to calculate heat losses.

### Studies on Cast Iron

Conditions obtaining in foundry practice have been vastly improved in the last 30 years, according to Richard Moldenke, in a brief paper before the 1922 meeting of the American Society for Testing Materials. Buying pig iron by its analysis is the rule everywhere and fracture is seldom an issue. The foundry foreman of today has no difficulty in calculating his mixtures chemically, and the composition of the various types of castings are almost standardized. Melting practice has now been placed upon a scientific basis in the foundry, so that there is little excuse for heavy losses from inferior metal.

There still remains, however, a critical study of the principles and practice connected with the rational gating of molds. Furthermore, many points in the following outline need investigation, in order to collect definite data on many still obscure problems relating to foundry practice.

I. Relation between chemical composition and physical properties, such as fusibility, fluidity, set, contraction, chill, hardness, strength, specific gravity, etc.

II. Influence of variations in foundry practice upon chemical composition and physical properties, as in the following summary:

**Mixture Characteristics:** Pig and scrap proportions, steel additions, charcoal or coke irons, "direct" blast-furnace metal.

**Metals' Characteristics:** Clean or with sand, rust, "burnt" scrap, shot, borings, salamanders and heavy section pieces.

**Melting Characteristics:** Rational or poor charging and melting practice in cupola or furnace, normal hot iron or oxidized "lifeless" quick-setting metal. Duplexing in electric furnace for better superheat, deoxidation and desulphurization.

**Temperature Characteristics:** Pouring temperature and rate of cooling due to mold surface characteristics, whether green or dry sand, metal molds, use of chills, section of castings, refractory quality of mold, gating of molds.

**Molecular Treatment:** Annealing, seasoning, rumbling, repetition, heating and cooling.

Effect on  
Grain structure.  
Internal shrinkage, porosity.  
Blowholes.  
Hardness.  
Strength.  
Internal stress.  
Carbon condition.  
Changes in other contained elements.

The following bad characteristics in castings are sufficiently important to warrant special mention in separate paragraphs:

III. **Shrinkage and Segregation:** As specially affected by composition, oxidized metal through bad melting practice, cold metal, irrational gating methods, insufficient feeding opportunity, low ferrostatic pressure.

IV. **Blowholes:** As specially affected by oxidized ("burnt") metal in charges or through bad melting practice, cold iron, low ferrostatic pressure, wet mold surfaces, wet or insufficiently vented cores.

# The Sulphuric-Acid Treatment Of Petroleum Products

BY CARL J. VON BIBRA  
Chemical Engineer

Chemistry of the Process—Action of Sulphuric Acid on the Various Hydrocarbons and Other Constituents of Petroleum—Review of Factors Affecting the Successful Application of This Treatment in Petroleum Refining

**M**OST of the petroleum products derived from either the ordinary distillation or the cracking processes must be refined before being placed on the market as finished articles of commerce. This refining generally takes the form of a chemical treatment. This is not always the case, however, as other methods depending on a physical action such as filtration are also in common use. Sometimes both chemical and physical methods of refining are employed.

The refining of petroleum products naturally divides itself into two branches. One of these, the refining of light oils such as gasoline and kerosene, has until recently been considered rather a simple process. It is now becoming more complicated, however, because of the greatly increased production of cracked oils. These require, as a rule, more careful and elaborate treatment than do the natural products obtained from the non-cracking distillation processes. The other branch of petroleum refining is that concerned with lubricating oils. This is a difficult matter at best. It has always been costly and tedious and is becoming more so all the time due to the increasing exactness of the trade requirements.

The present paper is to be confined simply to the treatment of petroleum products with sulphuric acid. The neutralization of the acid oil and any subsequent processes are considered proper subjects for separate discussion. This is also true of such matters as the actual dosages used in practice in the acid-treatment of individual oils.

## General Theory

All refining processes have as their object the removal of certain impurities in the oil which diminish and sometimes even destroy its commercial value. These impurities are either already present in the crude or else are formed during the distillation process. They are probably limited to organic bodies containing sulphur, oxygen or nitrogen. This would include the various asphaltic or bituminous substances that discolor the distillates, and sulphur alcohols, pyridines, etc., which give them an objectionable odor. The method of refining an oil, or treating it, as the chemical process is generally called, varies very much with the use to which the finished product is to be put. For instance, it would be wasteful to remove from an oil which is to be used exclusively as a gas engine fuel those substances which make an illuminating oil smoke or incrust the wick of a lamp. One of the most commonly used refining processes will now be considered in detail without reference to any particular kind of oil.

## THE SULPHURIC-ACID TREATMENT OUTLINED

The use of sulphuric acid in refining petroleum distillates is almost as old as the oil industry itself. This acid was used in the refining of coal oil by Gower as far back as 1792 and was adopted by the petroleum industry about 60 years ago. Despite the many years

that have elapsed since then, the chemistry of the sulphuric-acid treatment is still far from being fully understood. What takes place during the process is so complex that it taxes the imagination even to conjecture all the possible type reactions, much less actually to observe or measure them with any degree of accuracy. Much work has been done in the study of this process by many investigators and the results of some of this research are given here.

Very briefly put, the refining of distillates with sulphuric acid is accomplished by mixing the acid with the oil, generally in several doses, by means of air or mechanical agitation. The sludge, consisting largely of reaction products, is drawn off and the oil neutralized with caustic soda or other alkalis. It is finally washed with water to remove the excess of alkali and the alkaline reaction products, and the chemical refining is complete. In actual practice this system must be modified to suit the needs of the particular oil being treated.

At present let us study briefly the various hydrocarbons and other compounds found in petroleum, with particular attention to their behavior toward sulphuric acid, both concentrated and fuming. It may be pointed out that Gurwitsch<sup>1</sup> in his concise and classical volume "Wissenschaftliche Grundlagen der Erdölbearbeitung," has presented the theory of the reactions between sulphuric acid and the various hydrocarbon series in a very logical manner. Therefore his sequence of presentation will, in the main, be followed for this part of the discussion. However, in the light of more recent investigations, it is impossible to concur with him in all of his statements.

## PARAFFINES AND NAPHTHENES

When pure and under ordinary conditions, the paraffines and naphthenes do not react with or dissolve in either concentrated or fuming sulphuric acid. However, several investigators have succeeded in sulphonating naphthenes and normal paraffines with fuming sulphuric acid under special conditions in an experimental way. Both paraffines and naphthenes are quite freely taken up by cold sulphuric acid when they are mixed with other bodies which are themselves reactive with the acid. This is the condition that exists in actual practice, and in this way we account for the fact that an oil can be treated with one dose of acid after another until finally its volume is reduced sometimes as much as 80 per cent. Such is actually the case in the refining of water-white medicinal oil. It has not been established whether this consumption of paraffines and naphthenes is due to chemical reaction or adsorption. It is quite probable, though, that the non-reactive paraffines and naphthenes are mechanically

<sup>1</sup>Gurwitsch's work has recently been made available in English translation under the title of "The Scientific Basis for Petroleum Refining."



taken up—i.e., adsorbed, by the acid sludge. This sludge, a black viscous material, consists of the products formed when the acid reacts with certain constituents of the oil being treated.

Gurwitsch points out that the Imperial Russian Government required that the so-called asphalt content of petroleum products be determined by dissolving the oil in twice its volume of benzene and shaking with 20 per cent by volume of concentrated sulphuric acid. The increase in volume of the acid was taken as the asphalt content of the oil. He found that some residua showed more than 100 per cent of asphalt according to this test. On the other hand, however, after the benzene was distilled off, the acid-treated solution left a much larger percentage of oil as a residue than should have been the case considering the amount of "asphalt" adsorbed by the acid. For instance, a solution of 50 c.c. of residuum in 100 c.c. benzene was treated with 10 c.c. of sulphuric acid. Its volume decreased 28 c.c. The benzene was now distilled off. The oil remaining in the flask amounted to 36 c.c., not 22 c.c. as was expected. This, Gurwitsch feels, can be explained by assuming that the sulphuric acid removed not only certain constituents of the residuum treated but also 14 c.c. of the benzene. He proved this by diluting the acid sludge with water, neutralizing with soda lye and actually distilling off 14 c.c. of benzene. The same results were obtained when refined kerosene, consisting practically entirely of paraffines and naphthenes, was substituted for the benzene. All this certainly seems to point to an adsorption of the non-reactive hydrocarbons in the acid sludge.

#### AROMATIC HYDROCARBONS

Cold concentrated sulphuric acid attacks aromatic hydrocarbons only to a very slight extent and since nearly all technical sulphuric-acid treatments are given at atmospheric temperatures, one could scarcely expect to find true sulphonation of aromatics in the distillate taking place to any noticeable degree.

There are appreciable quantities of so-called sulphonic acids found in most sludges from ordinary cold acid treatments. Several authorities agree, however, that these in reality consist mostly of alkyl-sulphuric acids. Davis<sup>2</sup> found, for instance, that when the substances generally taken to be sulphonic acids are fused with caustic soda or potash no phenols are obtained. His particular work was done on bodies obtained from a California oil. Brooks and Humphrey<sup>3</sup> take exception to the views generally held and have pointed out that the higher benzene homologs are very readily sulphonated. Brooks and Bacon<sup>4</sup> have also shown that the fluorescent constituents of petroleum and its distillates are readily sulphonated by concentrated sulphuric acid, the result being the formation of fluorescent, water-soluble sulphonic acids.

The foregoing discussion applies only to concentrated sulphuric acid. If fuming acid is used at ordinary atmospheric temperatures, there is no question that sulphonation of aromatics goes on really vigorously and the sludge will show a yield of sulphonic acids corresponding to the percentage of aromatics in the raw distillate, provided, of course, sufficient acid was used to permit of the complete reaction. This effect is more

pronounced when fuming acid is used at elevated temperatures. Edeleanu and Gané,<sup>5</sup> in their investigation of the sulphonation of petroleum distillates, treated various fractions of Bustenari kerosene with 12 per cent fuming sulphuric acid at 80 deg. C. The losses in treating ranged from 6.23 to 10.96, averaging 7.53 per cent. They distilled the sludges with superheated steam and recovered in the neighborhood of 4.6 per cent of aromatics. These included xylene, mesitylene, pseudocumene and many hydrocarbons of unknown constitution such as  $C_{11}H_{16}$ ,  $C_{12}H_{18}$ ,  $C_9H_{10}$ ,  $C_{11}H_{12}$  and  $C_{12}H_{14}$ . The various sludges contained widely differing percentages of aromatic bodies. In the middle fraction the substances taken up by the acid consisted of 86 per cent of aromatics. In the last fraction (b.p. 258 to 292 deg. C.) they yielded only 10.6 per cent. By converting the sulphonic acids into chlorides and sulphamides Edeleanu and Gané also succeeded in showing that the fuming sulphuric-acid sludge contained disulphonic as well as sulphonic acids. A typical body of this class is m-xylene-disulphonic acid.

#### UNSATURATED HYDROCARBONS

It is among the unsaturated bodies that we find the greatest single source of trouble in the chemical treatment of petroleum products. Of all the hydrocarbons found in petroleum distillates the unsaturated ones are undoubtedly the most readily attacked by cold concentrated sulphuric acid. Unsaturated hydrocarbons, either straight-chain or cyclic, are far from being objectionable as fuel. In fact, because of their high carbon content as compared with the saturated paraffines and naphthenes, they are more desirable for this purpose. After all, in one form or another, this is the principal use to which all the light petroleum fractions are put. Even as lubricants the complex unsaturated hydrocarbons are desirable, as their viscosity is greater than that of the saturated bodies of corresponding boiling point.

Now the chemical activity of the unsaturated hydrocarbons is unfortunate in two ways: (1) The ordinary sulphuric-acid treatment, necessary to remove the impurities, also removes a considerable amount of these perfectly good constituents of the distillate. (2) The reaction products of the acid with the unsaturated hydrocarbons remain in solution in the refined distillate. These reaction products are neutral esters of sulphuric acid together with alkyl-sulphuric acids similar to those mentioned in connection with the action of sulphuric acid on aromatics. In cases where it is necessary to redistill the acid-treated and neutralized distillate, these alkyl-sulphuric acids can and very often do cause an endless amount of trouble by breaking up into alcohols and free sulphuric acid. The neutral esters also decompose rapidly at 140 deg. C. or higher temperatures.<sup>6</sup> Decomposition takes place, to a certain extent, even at ordinary temperatures. The liberated sulphuric acid attacks the steel of the still and its dephlegmating and condensing system. The annoyance and cost of frequent partial or complete shut-downs of a still plant because of the decomposition of these reaction products are known to have doomed the commercial operation of an otherwise feasible cracking plant the distillates of which could not be refined commercially without a final redistillation. Several other plants are

<sup>2</sup>Verbal communication; see also Hausmann, *Petroleum* (Berlin), vol. 5, p. 2301.

<sup>3</sup>*J. Am. Chem. Soc.*, vol. 40, No. 5 (1918), p. 848.

<sup>4</sup>*J. Ind. Eng. Chem.*, vol. 6, p. 623 (1914).

<sup>5</sup>*Monit. Roum.*, 1908, p. 493.

<sup>6</sup>See Brooks and Humphrey, *J. Am. Chem. Soc.*, vol. 40 (1918), p. 849.

seriously handicapped on this account at the present time, although they are commercially successful despite it.

The action of sulphuric acid on unsaturated hydrocarbons has been a moot question for many years. Until recently it was generally believed that sulphuric acid, especially fuming, would remove all unsaturated bodies from petroleum. The well-known analytical method of Kramer and Boettcher is based on this assumption. In this method unsaturated hydrocarbons are determined by shaking the oil with an equal volume of concentrated acid. While the conviction has gradually grown that figures obtained in this way are quite unreliable, it remained for Brooks and Humphrey<sup>7</sup> to prove this and to throw much valuable light on the complex chemistry of the unsaturated hydrocarbon-sulphuric acid reactions. These investigators state that the principal results of the action of sulphuric acid on the olefines are polymerization, the formation of secondary and tertiary alcohols and mono- and di-alkyl esters of sulphuric acid. None of the simple or mono-olefines which they studied yielded tars with concentrated sulphuric acids at 15 deg. C. This last statement is a direct contradiction of one of the long-established theories of oil refining. Brooks and Humphrey also found that with increasing molecular weight the tendency is toward polymerization, that the polymers are much more stable toward sulphuric acid than the parent olefines and that the more viscous and heavy polymers are found not in the acid sludge, but, to a large degree, in the oil layer. All the heavier olefines were found to be quite stable. The tars obtained in treating highly cracked oils are taken to be due to the presence of diolefines. Those obtained in the treating of lubricating distillates are also formed from diolefines and perhaps they may also be formed from a number of other substances.

#### BITUMINOUS SUBSTANCES

Very little is known about the constitution of those bodies which are responsible for the color in petroleum distillates. It is generally assumed that this color is due to the presence of bitumens. This belief is based on a certain amount of research work which has been done on this question but which so far has been entirely inadequate to establish anything but a number of widely differing theories. Even the nature of the effect which sulphuric acid has on bituminous bodies dissolved in petroleum distillates has been much debated. So, for instance, Schulz<sup>8</sup> explains the matter as being entirely an adsorption phenomenon. Ubbelohde,<sup>9</sup> on the other hand, considers the removal of these substances by sulphuric acid to be due to their precipitation from the oil, the acid serving merely as an agent to throw them out of colloidal solution. Gurwitsch<sup>10</sup> disagrees with both of these authorities and offers a number of excellent reasons for believing the reactions to be exclusively chemical, somewhat in the nature of a polymerization. It is not a polymerization in the ordinary sense of the word, according to this author, because an elementary rearrangement takes place, one result of which is the addition of sulphur to the polymerized molecules.

Despite our present ignorance of the exact chemistry

or physics of the case, the fact remains that bituminous substances can be completely removed from petroleum by the action of sulphuric acid.

#### ORGANIC ACIDS

Many crudes and their distillates contain organic acids of various sorts. Chief among these are the naphthenic and poly-naphthenic acids and the phenols. Markownikoff<sup>11</sup> found that an excess of concentrated sulphuric acid completely destroys oxygen-containing bodies such as these acids, also that the amounts of acid used technically are not large enough to bring about complete destruction of these substances. In fact both Zaloziecki<sup>12</sup> and Condrea<sup>13</sup> isolated naphthenic acids from acid sludge.

Any phenols present in unrefined distillates are not subject to the action of cold concentrated sulphuric acid any more than other aromatic bodies, with the exception of those homologs of high molecular weight. These, as has been pointed out previously, are likely to be sulpho-nated.

#### SULPHUR BODIES

There are several objections to the presence of sulphur in petroleum products. The element is found in oil in two forms, as free sulphur and as a constituent of complex substances of several types, either gaseous, liquid or solid. The gaseous and liquid sulphur compounds are generally characterized by an unpleasant if not unbearable odor and by the corrosive action of their decomposition products. Frequently sulphur bodies are responsible for the straw color of light distillates.

It is a difficult matter to discuss the effects, actual and possible, of sulphuric acid on sulphur compounds. This is because there are so many of them and furthermore so little is known of their structure. There is absolutely no relationship between the percentage of sulphur in an oil and the type or intensity of treatment necessary to remove all or at least most of it. It has been necessary to employ special processes in refining some oils which are handicapped by large amounts of sulphur in forms which stubbornly resist removal by sulphuric acid. The well-known Frasch process is a typical example of a chemical treatment designed specially to remove sulphur from oil. Usually, however, sulphuric acid will sufficiently remove those quantities and types of sulphur bodies which occur in the average petroleum. The so-called "doctor treatment,"<sup>14</sup> which has become widely used in late years, serves very well to reduce the sulphur content and improve the color of light distillates. In many refineries it has entirely replaced the sulphuric-acid treatment as applied to gasoline.

#### NITROGEN BODIES

Practically all petroleum contains some nitrogen. In most oils it occurs in negligible quantities or in the form of compounds which are not objectionable. At times, however, the oil to be refined does contain nitrogen in a form which is very obnoxious. This is specially true of cracked gasolines.<sup>15</sup> Little is definitely known of the constitution of the nitrogen bodies occurring in petroleum and its distillates. Most of them seem

<sup>7</sup>J. Am. Chem. Soc., vol. 40 (1918), p. 823.

<sup>8</sup>Petroleum (Berlin), vol. 5, Nos. 4 and 8.

<sup>9</sup>Ibid., vol. 4, p. 1395.

<sup>10</sup>Wiss. Gr. d. Erdöl. (1913), p. 186.

<sup>11</sup>Berl. Ber., vol. 16, pp. 1873-1883.

<sup>12</sup>Chem. Zeit. (1892), p. 905.

<sup>13</sup>According to Gurwitsch, loc. cit., p. 187.

<sup>14</sup>Sodium plumbite solution.

<sup>15</sup>See Brooks, J. Frank. Inst., vol. 180, p. 653 (1915).



to be pyridine and quinoline bases and are removed by concentrated sulphuric acid. Sometimes, however, it is necessary to use very dilute acid. Other substances, such as metallic oxides, have also been effectively employed to free oil of nitrogen-bearing impurities.<sup>16</sup>

### Factors Affecting Acid Treatment

Having considered, without going into detail, the chemistry of the sulphuric acid treatment, the next step leading to an understanding of the process is a review of those influences which may alter the final result.

#### THE CONSTITUTION OF THE OIL

The kind of acid treatment to be used depends almost entirely on the constitution of the distillate. Several general rules may be formulated—viz.:

1. The higher-boiling the fraction the more rigorous the treatment necessary to obtain a certain color or degree of refinement.
2. The quantity of acid required decreases with the narrowness of the fraction.
3. Cracked distillates require more treatment than do the natural distillates.

Let us consider a typical case to show the relationship between the boiling-point range of a distillate and the quantity of acid used in refining it. Two fractions were cut from a California crude. One was a kerosene distillate with a gravity of 38.5 deg. Bé. The other was a lubricating distillate of 22.2 deg. Bé. Both were about equally narrow fractions and were to be refined to a water-white color. The kerosene was given a total of 23 lb. of fuming acid and 4 lb. of 66 deg. Bé. sulphuric acid per barrel. The lubricating distillate, on the other hand, received 335 lb. of fuming and 20 lb. of 66 deg. acid per barrel, and finally was filtered in order to get the water-white color.

Two oils may have almost identical physical constants and yet differ very greatly in their make-up. This is illustrated by two lubricating oils with the following physical properties:

Oil No. 1	Constants	Oil No. 2
476	Saybolt viscosity at 100 deg. F.	462
365	Open-cup flash test	380
425	Open-cup fire test	435
No. 61	NPA color test	No. 61
24	Cold test, deg. F.	20
18.0	Baumé gravity, deg.	19.7

Oil No. 1 is a heavy California motor oil which consists of a very large fraction of lubricating distillates reduced to the proper viscosity and flash test. Oil No. 2 is a widely used brand of motor oil, also made in California, and consisting of a quite narrow cut run to specification and treated without further reduction. As shown above, their tests are practically the same. Yet Oil No. 2 requires only an average of 31 lb. of acid per barrel for treatment, while No. 1 requires 47 lb. Neither of the oils is filtered. Both are the product of combined fire and steam distillation in conventional cylinder stills manipulated in practically the same manner.

Cracked motor fuels invariably need treatment to remove objectionably smelling compounds. Also, they usually acquire a dark color quite rapidly when exposed to air. These oxidation products or the bodies from which they are formed must also be removed in order to give the distillate a marketable color or rather lack of color. On the other hand, most motor fuels which are not cracked, such as straight-run gasoline, for instance,

can be sold as finished products directly after distillation and without chemical treatment. If a chemical treatment is given it consists of just a small amount of sulphuric acid or perhaps only an agitation with sodium plumbite solution.

Cracked gasolines are hard to refine as compared with the natural product. Fortunately, due to lessened use and an increased supply of crude, it is no longer necessary to make cracked kerosene, at least in the United States.

Lubricating distillates are difficult to treat when in the best of condition. Cracked lubricating oils require a great deal more acid to bring them to a stable color than do those distillates in which cracked products are at a minimum. In fact, it is often absolutely impossible to refine a badly cracked lubricating oil.

#### STRENGTH OF ACID USED IN TREATMENT

While it is true that sulphuric acid in relatively dilute form (not less than 65 per cent  $H_2SO_4$  or 52 deg. Bé.) can be used successfully in the treatment of certain distillates, it has become general practice in the industry to work principally with two concentrations. Sulphuric acid of 66 deg. Bé. (sp.gr. 1.84 or 167 deg. Tw., 93 per cent  $H_2SO_4$ ) is used in refining most of the world's petroleum. In special cases 98 per cent sulphuric acid (sp.gr. 1.850) is used. This has been found to be better than 66 deg. acid for the refining of certain California distillates, particularly lubricants. In the making of high-grade kerosene or of water-white medicinal oils fuming sulphuric acid is used. This is generally of the 15 per cent  $SO_3$  form (about 103 per cent  $H_2SO_4$ ), although acid with 20 per cent free  $SO_3$  is sometimes used. There have been developments within recent years of the use of  $SO_3$  gas directly from the acid plant, but this could certainly not be called general practice.

There are two reasons why acids of such high concentrations as those just mentioned are used. In the first place, the quantity required to achieve a certain result in refining increases very rapidly the lower the concentration. Secondly, the more dilute the acid the more troublesome it is to ship and store. In fact, as is well known, sulphuric acid of less than 60 deg. Bé. cannot be shipped commercially in iron tanks.

The relation of acid concentration to results obtained is well illustrated by the following figures. A partly cracked distillate (sp.gr. 0.8245) was treated with acids of various concentrations. In all cases the temperature was 64 deg. F. at the start. The amount of acid used in each treatment was 2.5 per cent by weight.

Tests on Oil After Treatment	Strength of Acid in Per Cent $H_2SO_4$				
	70	93	96	99	103
					(15 Per Cent Fuming)
Saybolt, color, inches.....	10.5	17	20	25	22
Iodine No., Wijs.....	16.3	7.2	2.6	1.3	0.65
Doctor test.....	Sour	Sour	Sweet	Sweet	Sweet

It is clear from the above table that the refining action increases much more rapidly than the concentration of the acid. The only figure which is out of line is the darker color obtained with the fuming acid (103 per cent  $H_2SO_4$ ) as compared with that given by 99 per cent acid. This is often found to be the case and can be readily explained. Fuming sulphuric acid acts primarily by sulphonating and oxidizing unstable hydrocarbons rather than by polymerizing them. Many of these sulphonation products are soluble in the oil and consequently impart to it a darker color. As these products are more readily soluble in concentrated sul-

<sup>16</sup>In this connection consult Mabery and Hudson, *Am. Chem. J.*, vol. 25, p. 253 (1901); also Brooks and Humphrey, *J. Am. Chem. Soc.*, vol. 40, No. 5, p. 848 (1918).

phuric acid than in oil, the practice has been developed of agitating with a small amount of 66 deg. B $\acute{e}$ . acid (93 per cent H $_2$ SO $_4$ ) an oil which has been treated with fuming acid. In this way excellent colors can be obtained.

#### USE OF SLUDGE AND REGENERATED ACID

Only a part of the acid used in refining is used up in the process. For instance, a sludge from a typical California kerosene treatment with 66 deg. B $\acute{e}$ . acid had a Baum $\acute{e}$  gravity of 46.0 deg. (sp.gr. 1.47) and contained 64 per cent of H $_2$ SO $_4$  and 24 per cent of hydrocarbons. The sulphuric acid from such sludges is often regenerated and used for various purposes.

Where the fresh acid is given in several doses to the oil being treated and the sludge is drawn off after every agitation, the last one or two drainings frequently consist of fairly pure and concentrated acid. These drainings can be used to advantage in treating the next batch of oil, either as so-called "water acids" to remove any moisture in the oil or as a first dose of "acting acid" to aid in the refining.

Regenerated acid—that is, sludge acid from which water and organic substances have been removed as far as possible—does not usually lend itself well for further use in refining except in the manner indicated above for relatively clean sludge. At the present time considerable work is being done on the subject of acid recovery. Several very clever processes have come into use and the near future will probably see a commercial and generally acceptable method for making a really pure regenerated acid.

#### IMPURITIES IN SULPHURIC ACID

Nitrogen trioxide (N $_2$ O $_3$ ), nitrogen pentoxide (N $_2$ O $_5$ ) and selenium dioxide (SeO $_2$ ) have been found to be injurious impurities in sulphuric acid used for oil refining. Schulz,<sup>1</sup> the authority for the foregoing, goes into detail regarding the effects of various concentrations of these impurities. Kharitchkoff<sup>2</sup> also condemns the presence of nitrous and nitric acids and considers 0.05 to 0.07 per cent the maximum permissible. Bacon and Hamor,<sup>3</sup> after also quoting Schulz and Kharitchkoff on the effects of impurities, laconically add that acid-storage tanks in refineries should be subjected to periodical cleaning.

American commercial sulphuric acids are made in many degrees of purity. Analyses of several standard makes of contact acid showed the greatest impurities to be iron sulphates, sometimes also slight amounts of HCl and H $_2$ SO $_4$ . Traces of arsenic, lead and selenium were found in some of these acids. Nitric acid as an impurity is found only in lead-chamber acid. Contact-process acid made from brimstone is generally very pure. Below are typical analyses of acids supplied to southern California refiners by a large manufacturer:

	66 Deg. B $\acute{e}$ . Acid	99 Per Cent Acid	15 Per Cent Fuming Acid
Sulphuric acid, per cent. ....	93.30	98.96	103.48
Iron, per cent. ....	0.0056	0.0017	0.0031
Sulphur. ....	Nil	Nil	Nil
Lead. ....	Trace	Trace	Trace
Zinc. ....	Nil	Nil	Nil
Selenium. ....	Nil	Nil	Nil
Arsenic, per cent. ....	Nil	0.00001	Trace
Nitrogen compounds. ....	Nil	Nil	Nil

This same concern makes a commercial acid for the United States Navy so pure that it can be used as an electrolyte when diluted.

Finally one cannot help but feel that while certain difficulties in refining might possibly be laid to inorganic impurities in the acid, there are at least half a dozen other factors in the acid treatment which are more likely to account for these troubles.

#### QUANTITY OF ACID USED IN TREATING

The desired results in refining with sulphuric acid cannot be obtained simply by using larger and larger quantities of acid. There is a very definite limit beyond which it is no longer feasible to use additional amounts of acid. This limit is set by the following considerations:

(1) The refining power of the acid is not proportional to the quantity used. In fact, it diminishes very rapidly, as is shown by figures obtained in the treatment of a California lubricating distillate from Coalinga crude:

66 Deg. B $\acute{e}$ . Acid Used (Percentage by Weight)	Color of Finished Oil (NPA Scale)
5	5
10	3
15	2
20	1½
50 (including 30 per cent fuming acid)	1

(2) If too much acid is used the distillate is apt to be "burnt." By this the practical refiner means that the treatment has been so rigorous that those delicate and probably aromatic compounds which give a pleasing "outer-tone" or fluorescence to the oil have been destroyed. This applies mostly to lubricating oils, since in refining light distillates one of the principal objects is to remove all trace of color, even of "outer-tone." An acid-burned oil generally has a dirty, brownish or bluish tinge.

(3) The more viscous the oil the more liable it is to the formation of emulsions. These emulsions are usually the result of a heavy acid treatment. An emulsion is a serious problem and when broken almost always yields a darkened oil and a large loss.

#### USE OF THE ACID IN DOSES

It is general practice to apply the acid used in treating in several doses. There are several very good reasons for this. In the first place, most oils are treated at as low a temperature as possible. If sulphuric acid, especially fuming, is mixed with the oil in large quantities the heat of reaction will probably raise the temperature too high. Secondly, most distillates contain a certain amount of free water or at least moisture. If this should be permitted to dilute all the acid, its effectiveness would be materially reduced. Therefore the first dose, or "dump," as it is generally called in practice, is used to remove this water. The succeeding doses can then act on the oil at their original concentration. Thirdly, aside from the question of dilution by water it has been found that a fixed quantity of acid has considerably greater refining power when applied in several small doses rather than in one large one. Since the action of the acid on the oil is partly a solvent action, this behavior is in keeping with the well-known physicochemical principles of solutions.

In speaking of applying the acid in several doses it is assumed, of course, that the sludge is drawn off after each dose has been agitated. Otherwise the final effect would be quite the same as when the acid is given all at once.

Gurwitsch thinks that the good effect of giving the acid in fractional portions is probably due to the fact

<sup>1</sup>Chem. Zeit., vol. 35 (1911), p. 1129.

<sup>2</sup>Westnik shirov. westsch., vol. 6 (1905), p. 119.

<sup>3</sup>Amer. Petroleum Industry (1916), p. 583.



that sulphuric acid often reacts in several stages with the asphaltic and unsaturated compounds of high molecular weight. Even at the beginning or first stage reaction products are precipitated from the oil. In refining certain petroleum products he noticed that even with the addition of small amounts of acid a very weakly acid sludge separated out. Most of this is soluble in benzene. If this sludge is treated with additional quantities of sulphuric acid, it loses its solubility in benzene almost entirely. Now, on the other hand, if the raw (unrefined) product is treated with a single liberal dose of acid, the same insoluble sludge is formed. In cases like this it is very easy to see that the use of acid in several doses must be more effective than a single dose. In the latter case some of the acid performs the entirely useless work of changing still further the reaction products which have already separated from the oil.

#### THE EFFECT OF TEMPERATURE

The temperature at which the acid treatment is carried out is an extremely important matter. A general rule followed by most refiners is to treat at just as low a temperature as possible. This rule is based on the fact that one of the principal objects in refining most petroleum distillates is to make them as nearly colorless as possible, and this can best be done at low temperatures. The lack of color in an oil does not necessarily indicate a high degree of refinement. However, the trade is prone to judge an oil by its appearance and often blindly assumes that the best looking oil is really the best. This is equally true of light oils such as motor fuels and of lubricating oils.

The only exceptions to this rule of treating at low temperatures are kerosene and sometimes steam-cylinder oil. If a really high-grade kerosene is desired it should be treated hot, as the sulphonating power of the acid increases rapidly with the rise in temperature and aromatic bodies must be removed as completely as possible. The removal of unsaturated hydrocarbons and bituminous substances is also accelerated by the hot treatment. The color of hot-treated oils is generally poor, and this defect is remedied by an after-treatment at relatively low—i.e., atmospheric—temperatures with 66 deg. acid or by filtration through bone black or other decolorizing material. When treating steam-cylinder oils there is an entirely different reason for treating it hot. The object is to reduce sufficiently the viscosity of the oil to make treatment possible. Beyond this any excess heating is carefully avoided. It might be argued that it is not necessary to treat cylinder oils or other heavy lubricants in their natural condition, the practice usually being to dilute them with a light naphtha sufficiently to reduce the viscosity and then to remove the naphtha after treatment or filtration. This is true, but not always feasible. There are steam-cylinder oils made which will not stand the distillation after treating necessary to remove the admixed naphtha and such oils must necessarily be treated hot.

Zaloziński,<sup>20</sup> as a result of his study of the acid treatment of a Galician kerosene, published the table given in Table I.

This table is self-explanatory. Zaloziński interprets the unsatisfactory color obtained at elevated temperatures in the following manner: Colored oxidation products are freely formed at these temperatures and reactions

resulting in the formation of free water are accelerated. The result of the latter is a dilution of the acid, and this in turn causes certain oil-soluble asphaltic substances to pass out of the acid solution into the oil and thus discolor it.

#### THE EFFECT OF LIGHT

Possible effects of light on the results of acid treatments are disregarded in technical procedures. Acid lubricating oils darken rapidly on exposure to direct

TABLE I—STUDY OF ACID TREATMENT OF A GALICIAN KEROSENE

Temperature, Deg. C.	Acid Sludge, Grams	Unused H <sub>2</sub> SO <sub>4</sub>	Sulphonic Acids Calculated as H <sub>2</sub> SO <sub>4</sub>	Acidity of the Kerosene Terms of H <sub>2</sub> SO <sub>4</sub>	Polymerization Products	Color in mm. as Compared With an Arbitrary Glass
0	61.6	47.91	1.45	0.86	5.25	193
5	62.0	46.82	1.55	1.42	5.02	166.5
10	62.5	46.53	1.65	1.56	5.13	143.0
15	63.5	45.72	1.93	1.76	5.40	112.5
20	64.3	44.37	2.22	2.45	4.93	89.5
25	64.8	43.52	2.68	2.63	5.62	80.5
30	65.2	41.87	3.72	3.65	5.43	52.0
35	65.8	40.42	4.90	4.15	6.18	Straw
40	66.0	39.03	5.62	4.83	5.78	Straw
45	66.4	38.62	5.76	5.62	5.21	Straw
50	67.0	37.26	4.81	5.91	4.81	Straw

light, while the same oils darken only very slowly in diffused light or darkness. Zaloziński found that the acidity was higher and the color darker when a Galician kerosene was treated in diffused light than when it was treated in the dark.

#### METHOD OF MIXING ACID AND OIL

Three methods of mixing chemicals with the oil being treated are used in practice. The one used originally was mechanical and is illustrated by the gear-driven paddles used in grease kettles. Mechanical agitation is at present used only in special cases, mostly when oxidation by air is to be avoided. In most treatments the acid is now mixed with the oil by means of an air blast. In this way rapid, thorough and relatively cheap diffusion of the acid through the oil is obtained. Air agitation, however, has its drawbacks. First, it oxidizes the oil. This is a serious consideration in the case of cracked distillates or oils being treated at elevated temperatures. Second, the air almost always contains considerable water. This dilutes the acid and greatly reduces its efficiency. Third, when light distillates are agitated with air, the evaporation losses are prohibitive. Consequently oils like gasoline are mixed with the acid or other substances by means of a circulating pump. This takes suction near the top of the agitator and pumps the oil in at the bottom.

#### THE TIME FACTOR IN TREATING

The length of time required to utilize the full refining value of the acid depends on a number of modifying circumstances. Among these the most important are: (1) Method and violence of agitation. (2) Size and shape of the apparatus. (3) Viscosity of the oil. (4) Quantity of acid used and number of dumps in which it is applied to the oil.

When the oil is being treated in separatory funnels in the laboratory, a few minutes violent shaking by hand generally suffices. In agitators of 500-bbl. to 2,000-bbl. capacity light distillates are usually agitated by air for periods varying from 15 minutes to 1 hour. If circulation by pump is used as a method of mixing, the time is increased to as much as 16 hours or more.

<sup>20</sup>Chem. Zeit. (1895), p. 875.

The time limit in acid-treating lubricating oils may be defined more closely. It is safe to say that the average large-scale batch varying, say, from 25 to 1,200 bbl. cannot be intimately mixed with acid in less than half an hour. Complete mixing should be attained in 2 hours, at any rate. Needless prolonged contact between the acid and the oil is harmful. This is because part of the sludge will dissolve in the oil and thus discolor it. Also, long agitation of acid lubricating oils frequently results in emulsions after the addition of an alkali solution as in the ordinary method of treating. While this is true no matter by what means the oil is agitated, it must be borne in mind that the influence of air is especially bad because of its oxidizing effect.

For a long time the separation of the acid sludge from the oil in which it is suspended was a serious problem in oil refining. Of course, the light oils have such a low viscosity and specific gravity that the heavy viscous sludge settles out almost immediately. Such, however, is far from being the case with lubricating oils, especially the more viscous ones.

Formerly the oil was freed from sludge either by long settling or by centrifuging. The former method injured the oil because of the length of time in which it had to remain in the acid condition. The latter procedure was very expensive and the lead-lined centrifuges used were constantly in need of repair.

During the last 25 years it has become universal practice to "knock down" the sludge from the acid-treated oil. This practical expression really means that the very finely divided sludge particles are gathered together into nodules sufficiently heavy and compact to settle out of the oil. This result is accomplished by sprinkling cold water or caustic-soda solution on the oil while agitating it very gently. Before the sludge is "knocked down" the oil has a color ranging from blue to purple. The oil is more purple when it has been treated with a large amount of acid. After all the sludge is gathered and precipitated the oil takes on a color ranging from green to yellow. The acid treatment is now complete and the oil is ready to be neutralized.

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## Mechanism of Metallic Oxidation at High Temperatures\*

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THE corrosion of metals is one problem of great economic interest upon which much time and thought have been expended over a period of many years. In the effort to avert the destructive action of a hostile environment, attention has naturally been directed almost entirely upon the conditions under which an overwhelming majority of metallic structures are called upon to perform, and the extensive and complicated phenomena attending the corrosive action of atmospheric agencies, acting at the ordinary atmospheric temperatures, have been studied voluminously, although a unanimity of opinion regarding many fundamental facts in the mechanism of corrosion is even now far from being reached.

One somewhat neglected type is the corrosive action of various gases upon metals when exposed to temperatures considerably higher than the atmospheric range, and more especially the attack of atmospheric oxygen upon exposed metallic surfaces. That the problem is a difficult one to contend with is connoted by the practical dominance of industrial electric heating by alloys of one type (nickel-chromium). Proprietary interest may account in part for the paucity of information publicly available in the technical literature upon even the most general factors determining the behavior of metals and alloys exposed to such exacting conditions.

The present brief paper is an account of some conclusions reached as the result of experimental work extending over several years; it is unburdened of much perhaps desirable experimental detail and proof.

High-temperature metallic oxidation may be considered as a phase of metallic corrosion. The scheme

**Rapidity of Corrosion in Heated Atmospheres Is Not Determined by Any Property of the Metal but by Some Combination of Physical Properties of the Oxide and Its Ability to Absorb and Diffuse Oxygen**

outlined below, in which corrosive agent and environment are the principal criteria, is one way of analyzing the several groups of corrosion phenomena.

### Erosion:

Disintegrating or destructive action by *physical* causes.

### Corrosion:

Disintegrating or destructive action by *chemical* causes.

#### Low-temperature corrosion:

Solid participating phases essentially immobile.

Gaseous agent.

Liquid agent.

Action electrolytic.

Action non-electrolytic.

#### High-temperature corrosion:

Solid participating phases possess diffusive mobility.

Liquid agent.

Gaseous agent.

Reducing gases.

Oxidizing gases.

Water.

Miscellaneous elemental and combined.

With the exception of the division between high- and low-temperature action, the classification is obvious enough. High and low are only relative terms, with no boundary between them. Similarly, there is no reason for the statement that diffusion is inoperative at a certain low temperature; but there is an essential difference due to the fact that when the temperature is raised sufficiently the forces of diffusion not only become active, but active with such rapid amplification as to become dominant forces. The diffusive mobility of the solid constituents of alloys when highly heated is a property recognized by every metallurgist, and some of the fundamental operations of physical metallurgy, such as the heat-treatment and cementation of ferrous alloys, rest upon it as a foundation. The solution and diffusion of gases in solids are appreciated by all who have had occasion to handle hot hydrogen.

\*A paper presented before the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, Rochester, June, 1922.



## NOBLE AND BASE METAL

Oxidation is a chemical reaction, and a reversible one—that is, in the presence of oxygen at a sufficiently high temperature, a metal may be oxidized, or its oxide decomposed, by suitably adjusting the pressure (concentration) of the oxygen atmosphere. At pressures greater than the equilibrium dissociation pressure of the lowest oxide, oxidation occurs; at lower pressures the oxide decomposes and the metal is unchanged in contact with free oxygen. This dissociation pressure is not a constant, but increases with rising temperature somewhat after the fashion of vapor pressures. Silver and palladium are standard examples in which at atmospheric pressures oxidation occurs at low temperatures and reduction at higher ones.

The first great division in the behavior of the metals may be made on the basis of the order of magnitude of the dissociation pressure of the lowest oxide, serving to separate the noble from the base metals. The former fall within the range of atmospheric pressures and above; the latter are extremely minute—e.g., at 1,000 deg. C. the dissociation pressure of cuprous oxide is estimated<sup>1</sup> to be of the order of ten-millionths of an atmosphere. Included in the few metals which may be classed as non-oxidizing by this distinction are gold, platinum, rhodium, silver, palladium and some chemically similar metals.

## DENSE OXIDE FILMS IMPEDE CORROSION

The base metals—the oxidizing metals—comprise the remainder of the common metallic elements, and a second division may be made among them based on the physical texture of the oxide which is formed. Here the determining factor is one of relative metallic and oxide density. As the surface of a metallic wire, for example, is being oxidized a cylindrical shell of metal is replaced by a cylindrical shell of oxide, which may or may not take up more space than the former. The characteristic of the formation of subsequent layers of oxide depend upon which of these conditions is fulfilled. If the layer of oxide formed takes up more space than the volume of metal which was oxidized to produce it, the oxide layer forms a tight fitting, solid sheet; if the reverse is the case, there is more space available within the original metallic dimensions than the oxide density requires, and a porous, brickly structure is the result. In the former case, the enveloping oxide layer may impede further oxidation; in the latter, by virtue of its porosity, it does not. The critical density ratio is given in the expression

$$\frac{Wd}{wD}$$

in which

$W$  = molecular weight of oxide formed.

$w$  = formula weight of metal.

$D$  = density of oxide formed.

$d$  = density of metal.

The cellular oxide structure results when this ratio is less than unity; the solid crystalline oxide when it exceeds unity. Table I gives values for this critical ratio computed from data available in current physical tables.

Those metals which fall into the cellular oxide structure group comprise most of the so-called light metals, and the characteristics of oxidation of the group have

been confirmed experimentally with magnesium and calcium. Wires of these two metals heated in dry oxygen below their ignition temperatures (about 525 deg. C.) form oxide coatings the thickness of which increases directly proportionally to the time of oxidation—that is, the formation of an oxide film does not interfere with the speed at which subsequent films are formed. After complete oxidation of a calcium wire, the resulting lime wire had the same micrometer diameter as the initial metallic diameter, and from the known densities of calcium and calcium oxide it appears that 45 per cent of the volume of this lime wire was void. A steady stream of oxygen will pass through this porous layer to the oxidizing metallic surface without detectable impedance; expressed differently, the oxygen pressure gradient through an oxide coating of this type is zero.

The remaining large group, which is composed of the majority of the common metals, form compact enamel-like jackets of oxide, being free to expand outward as they form, and all exhibit the common property of

TABLE I—CRITICAL DENSITY RATIOS OF METALS AND THEIR OXIDES

Metal	Ratio	Metal	Ratio
Aluminum.....	1.28	Manganese.....	2.07
Barium.....	0.78	Nickel.....	1.68
Cadmium.....	1.32	Potassium.....	0.51
Caesium.....	0.42	Silicon.....	2.04
Calcium.....	0.78	Sodium.....	0.32
Chromium.....	3.92	Strontium.....	0.69
Cobalt.....	2.10	Thorium.....	1.36
Copper.....	1.70	Tin.....	1.33
Iron.....	2.06	Tungsten.....	3.30
Lead.....	1.31	Zinc.....	1.59
Lithium.....	0.60	Zirconium.....	1.55
Magnesium.....	0.84		

suffering a progressive decrease in rate of oxidation at constant temperature, proportional to the thickness of the layer of oxide formed. This leads at once to a parabolic relation between time and quantity of oxidation, the square of the weight of oxide formed per unit of surface being proportional to the time of oxidation. Quantitative verification of this fact has been obtained with copper, iron, nickel, zinc, lead, cadmium and aluminum. At any time the rate of oxidation is inversely proportional to the thickness of the layer of oxide then on the surface. The fact that this rate varies quantitatively with the amount of oxide overlying the metal surface points to an important conclusion: that the speed of the reaction is not determined by any property of the metal at all, but is determined by some combination of physical properties of its oxide. To explain the known differences in the behavior of the metals as regards high-temperature oxidation metallic properties may be forgotten, but a knowledge of the characteristics of their oxides is imperative. It is unfortunately the case, as will appear later in this discussion, that the determinative properties are of a type in which quantitative information at the present time is almost wholly lacking.

## SOLUBILITY OF OXYGEN IN OXIDE LAYERS

The way in which the oxide layer limits the rate of oxidation can only mean that the transmission of oxygen through this layer to the reaction surface, which is the juncture of metal and oxide, is effected against a resistance which is proportional to its thickness. For many reasons it appears that this transmission must be accomplished by the actual solution of oxygen in the metallic oxide, and its diffusion while in the dissolved condition from the outside to the inside sur-

<sup>1</sup>W. Stahl, *Metallurgie*, vol. 4, p. 682 ((1907)).

face. The motive force of diffusion is difference in concentration, and speed of diffusion is determined by: (a) the concentration gradient of the diffusing substance, (b) the diffusional resistivity of the obstructing medium.

In the case of metallic oxidation, the concentration of free oxygen at the reaction surface is maintained at or very near to a value corresponding to the oxide dissociation pressure; at the outer surface it is that of the maximum solubility of oxygen in the oxide, and the difference between the two is the operating force causing a steady stream of free oxygen to pass through.

The critical oxygen pressure which we interpret as bearing a close relation to maximum oxygen solubility may be determined by rate observations in oxygen atmospheres of varying tenuity,<sup>2</sup> and the diffusional resistivity deducted from it and the diffusion rate. In Table II a comparison of the critical constants for three metals is given for a temperature of 900 deg. C.

TABLE II—CRITICAL OXIDATION CONSTANTS FOR THREE PURE METALS

	Electrolytic Copper	Electrolytic Iron	Electrolytic Nickel
Rate of oxidation g./sq.cm./hr. ....	0.000127	0.00065	0.0000076
Diffusional resistance of oxide (arbitrary units).....	2,840	310	50,000
Critical oxygen pressure mm. Hg (maximum solubility).....	0.36	0.20	0.04

Nickel at this temperature is 165 times as resistant to oxidation as copper, and this is due both to an oxygen solubility one-tenth as great, and a resistance to diffusion seventeen times greater, of nickel oxide as compared with cuprous oxide.

#### RATE OF OXIDATION AT ELEVATED TEMPERATURES

The way in which the rates of oxidation change with temperature, according to our previous analysis, is equivalent to the temperature change in diffusivity of oxygen through oxide, inasmuch as the corresponding change in oxygen solubility appears to be slight. The quadratic rate constant (isothermal) for all of the metals we have examined is related to the temperature of oxidation according to the type equation

$$k = AT^n,$$

a parabolic equation in which

$k$  is the rate constant,

$T$  is the absolute temperature, and

$A$  and  $n$  are characteristic constants.

The shape of the curve is determined by the value of  $n$ , which is different for the several metals, but always fairly large, usually between 10 and 20. The rate of oxidation thus changes very rapidly with temperature; but the very generality of the equation makes a simple comparison between two metals difficult, except in the very special case, which unfortunately is quite unlikely, when the exponents are equal. Thus the ratio between the isothermal oxidation rates of two metals varies with temperature and may even reverse in relative magnitude.

As to the fidelity with which metallic oxidation follows this simple law, we can only say that in the case of copper, experimentally observed points in the temperature range of 400 to 1,000 deg. C. lie on this curve with surprising closeness, although at temperatures of 600 deg. C. and below there are deviations in the direc-

tion of faster rates, which approach the theoretical rates as a lower limit. The cause for this deviation is apparently due to fissuring of the protective oxide coating by the expansive action of the formation of new underlying oxide layers, and the failure of the original oxide surface to accommodate itself to the expansion on account of insufficient plasticity.

Aluminum and cadmium behave in an anomalous manner in that oxidation proceeds according to the parabolic law as is required by their density ratios, until an oxide coating which is truly hardly more than a film is formed, whereupon further oxidation ceases. At a temperature of 600 deg. C. this film forms upon aluminum in about 60 hours, and further exposure up to 900 hours brings about no increase. This critical oxide film weighs about 0.00010 gram per square centimeter, corresponding to a thickness of 0.00002 cm.

#### The Romance of Helium

The story of helium, its discovery, development, uses and methods of production is told in a recent Bureau of Mines bulletin by R. B. Moore, chief chemist. In the words of the report, the story of helium is one of the romances of science. It is one of the best examples of a discovery in pure science that has wide commercial application. In 1868, an eclipse of the sun was visible in India. Several scientific men who were in India making observations of the eclipse turned a spectroscope for the first time on the solar chromosphere—that part of the atmosphere of the sun, about 10,000 miles deep, which merges into the corona. A bright yellow line was observed and was thought at first to be due to sodium. Janssen showed, however, that this line was not just the same as either the  $D_1$  or  $D_2$  line of sodium, although it was extremely close to these lines, hence he suggested that the new line have the designation  $D_3$ . Frankland and Lockyer decided that  $D_3$  was due to an element in the sun not previously discovered on the earth and suggested for it the name Helium from the Greek word *Helios*, the sun.

For several years nothing more was done in connection with this element. In 1894, Sir William Ramsay, in conjunction with Lord Rayleigh, made his memorable discovery of argon in the atmosphere, which was announced at the British Association meeting in the same year. After this discovery, Ramsay looked for other sources of the element. Through Sir Henry Miers, he learned that W. F. Hillebrand, of the United States Geological Survey, had obtained an inert gas from certain uranium minerals which he had decided was nitrogen. Ramsay, believing that part of it might be argon, obtained from Hillebrand a sample of the mineral, cleveite and after extracting gas from the mineral and purifying it, he ran it into a spectrum tube. The lines obtained were, however, different from those of argon. Among them was the bright yellow line noted by Janssen. Thus was terrestrial helium discovered.

Possessing great lifting power and being non-flammable, helium is recognized as superior to hydrogen for use in dirigibles. Another advantage of the gas for this use is that it diffuses through a fabric at about three-quarters the rate of hydrogen; its non-flammability makes it possible to place the engines in the framework of the dirigible, thus getting a direct drive, giving greater control of the craft and much increased speed for any given horse power.

The bulletin also describes manufacturing processes.

<sup>2</sup>For instance, if metallic wires are oxidized in oxygen at various pressures, the rate of oxidation is but slightly influenced by the gas pressure as long as the latter is below a certain value ("critical oxygen pressure"), but is directly dependent at higher gas pressures.



## Heating Coke Ovens With Blue Water-Gas

By J. F. O'MALLEY

Superintendent of Gas Manufacture, Empire Gas & Electric Co.

THE Empire Gas & Electric Co., of Geneva, N. Y., recently encountered a serious threefold problem. First, it was necessary to provide additional gas-producing capacity. Second, the plant must be made flexible to the point where coke production could be made to fluctuate as nearly as possible with the demand. Third, the necessity of stocking thousands of tons of coke in excess of requirements with a sluggish coke market showing little prospect of immediate improvement must be avoided. All these results were accomplished through the erection of a blue water-gas plant to supply fuel gas for heating the byproduct coke ovens, in place of using lean oven-gas as had been the former practice. The adoption of this blue-gas for heating has in fact practically doubled the surplus gas-producing capacity of the plant; and, in addition, it gives a greater flexibility of operation than could previously be obtained.

### ADVANTAGES OF SEPARATE HEATING GAS SUPPLY

In operating a byproduct coke plant for the production of fuel gas, where several communities depend upon the plant for gas for their daily needs, it is necessary to maintain a sufficient supply to meet these needs and also to anticipate future demands of an ever-increasing gas consumption. It is also necessary under these conditions to maintain a quality of gas which conforms with the required standards. The coke produced must be of first-class quality so that it may find a ready market. This last is particularly germane in a plant where gas is the principal product, as the coke from such a plant must compete with that from plants where coke production is the prime consideration.

Where lean gas is used for heating the ovens and only the surplus of rich gas is sold, the operation is of necessity a balanced one. Both the lean and the rich gas must come from the coal charged. If the coal charging is interrupted for any reason, the gas production will automatically fall off, which results in a shortage of surplus gas and also of heating gas. As a result it is often a case of "robbing Peter to pay Paul" for a time, while "green" ovens are pushed to build up the gas supply and a poor quality of coke results.

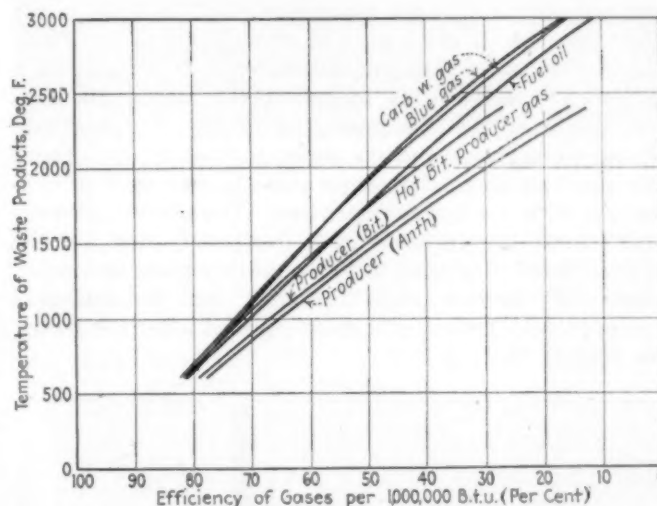
These are the problems that make successful byproduct coke plant operation difficult and at times almost impossible, especially where a plant has gone through many years of service, and repairs and replacements are of frequent occurrence. A blue-gas plant, being an entirely separate gas-making unit using coke as fuel, fits into this situation exactly. And even though other conditions remain the same, if such gas is used to supply the ovens, it liberates an equal amount of oven-gas for sale as fuel.

The advantages of having a separate source of supply for heating gas which can be started and stopped on short notice is evident, for with it heats can be maintained irrespective of oven conditions much better

than when the lean gas is used for heating. For such a separately generated gas, blue water-gas is much superior to producer-gas in that it has a higher flame temperature. Producer gas, having a greater percentage of inerts, must necessarily give a flame of lower temperature.

### ADDITIONAL ADVANTAGES OBTAINED

In addition to adding increased production of salable gas to the plant's output, there are other advantages, depending largely on local conditions, which may be realized from such a separate source of heat. It may be used to regulate the coke production more closely to suit market conditions and thus prevent the accumulation of large stocks. This is done by operating only enough ovens to take care of the gas requirements, using all oven-gas for outside demand and heating with



THEORETICAL COMBUSTION EFFICIENCIES  
OF VARIOUS GASES

blue-gas made from the coke. The coke production can be cut practically in half in this way.

The blue-gas auxiliary also permits the use of coals containing smaller amount of volatile than could be used without its aid. Thus coals especially suited for making foundry coke, may be employed in a plant where gas is the principal product, even though these coals are low in volatile. There are also times when high-volatile coal is difficult to obtain, and here again the low-volatile coal can be used and still sufficient gas be obtained.

Again, by the use of the blue-gas auxiliary, the total coal which must be carbonized for a given output of gas to consumers is greatly lessened. In times of coal shortage, when the only consideration must be to keep the supply of domestic gas at its normal level, this fact allows the storage pile to cover a longer period and may

Blue Water-Gas Heating Doubles Surplus Gas From Ovens, Eliminates Carbon From Heating Flues and Permits Uniform Oven Operation, Without Change of Oven Burners or Other Parts of Fuel-Gas System

be of great aid in saving the communities served from serious hardships.

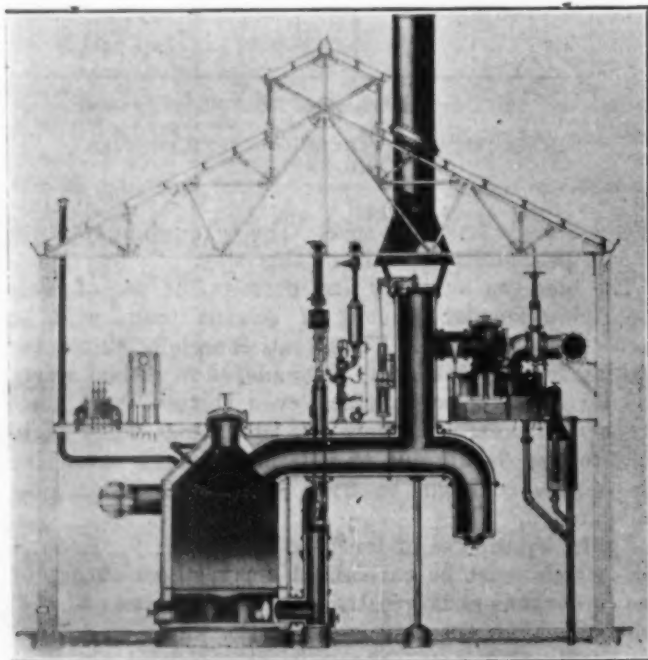
#### DESCRIPTION OF PLANT OF EMPIRE GAS & ELECTRIC CO.

The Empire company's gas plant consists of forty-six byproduct coke ovens of Semet-Solvay design and construction. Thirty of these ovens are four flues high, 15½ in. to 17 in. wide from pusher to coke side, 35 ft. long, and have a capacity of 7 tons each per charge. The sixteen ovens remaining are five flues high, 15½ in. to 17 in. wide, 35 ft. long, and have a capacity of 10 tons each per charge. These ovens are of the usual silica brick construction. Operating at approximately 20 hours average coking time, they carbonize 425 tons of coal per day, giving a total gas yield of over 4,000,000 cu.ft., of which 2,000,000 can be considered as surplus gas.

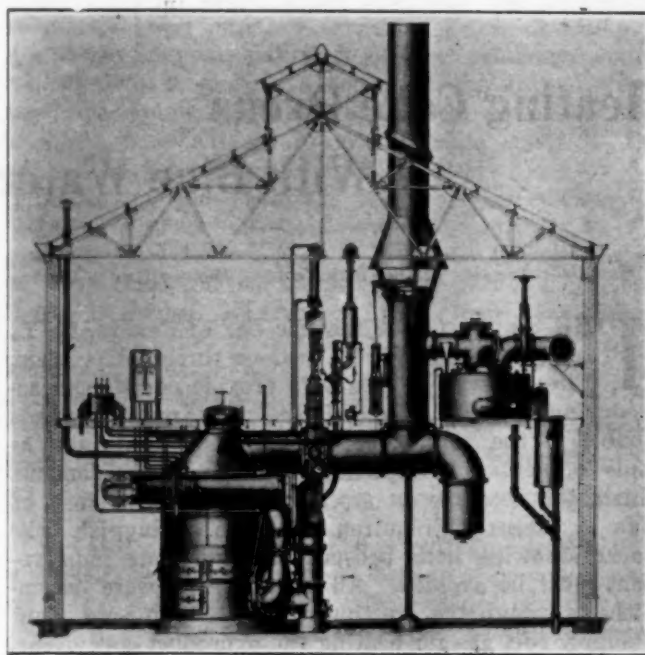
This surplus gas is distributed to nine cities and towns in the Empire territory as follows: Geneva, Auburn, Waterloo, Seneca Falls, Cayuga, Phelps, Newark, Palmyra and Lyons. The largest of these cities are Geneva and Auburn. The farthest point of delivery is Auburn, which is served by 25 miles of high-pressure main from Geneva.

#### THE AUXILIARY BLUE-GAS PLANT

The blue-gas plant was designed and erected by the U.G.I. Contracting Co., of Philadelphia, Pa. It consists of a generator building containing two 9-ft. diameter blue-gas generators and their necessary piping and accessories. These generators, of 7 ft. 2 in. inside diameter, have a grate area of 40.35 sq.ft. each. Their capacity is approximately 1,750,000 cu.ft. of gas each daily. The accessories include U.G.I. automatic control machines for the operation of the set; and two blowers, one motor and one steam turbine driven. There are also two steam-driven pressure pumps used in connection with the control machines. The motors, blowers and pumps are inclosed in a dustproof room on the ground floor. Included in this auxiliary plant is a relief holder of 100,000 cu.ft. capacity and a condenser equipped with sprays and grids—placed after the holder for cooling the gas.



SECTION THROUGH BLUE-GAS GENERATOR AND PIPING



ELEVATION OF BLUE-GAS PLANT

Steam for this blue-gas plant is generated in waste heat boilers and in boilers fired with coke breeze by Coxe stokers.

The handling equipment for feeding coke to the generators comprises a track hopper, a steel apron feeder and a belt conveyor. The belt conveyor has a travel of 200 ft. and is equipped with a 20-in. rubber-covered belt. This conveyor discharges into a storage bin and from there by chute to a charging car on the operating floor of the generator building.

Provision for future extension to this unit has been allowed in the layout. Space in the present building has been reserved for the installation of carburetors, by means of which the blue-gas could be enriched to the required heat and illuminating values for distribution to consumers, should such prove to be desirable.

#### OPERATING MECHANISM AND METHODS

The automatic controls add greatly to the efficiency of the plant. When they are set and timed to run in a proper manner, the plant practically operates itself. All of the steam valves, air valves, stack valves, etc., are opened and closed automatically, being timed to the second. Much more efficient results are thus obtained than is generally possible by hand operation. The temperatures throughout the fuel bed are maintained within narrow limits, due to short cycles. The fuel bed is operated at its highest efficiency, producing a uniform quality of gas and a clinker which is easily and quickly removed.

The generator, a cylindrical steel vessel lined with insulating lagging and refractory brick, is provided with self-sealing doors, one at the top through which the fuel is fed, others giving access to the fire at the grate level, and one at the bottom. The air supply for blasting the coke to the proper temperature for gas generation enters the bottom of the generator, where it is controlled by a valve. The blast products, escaping from the top of the fire, pass through outlet connections controlled by special gas and stack valves, thence through the stack to the atmosphere. The installation is not equipped with waste heat boilers, although pro-



vision has been made so these may be installed in the future.

The hot gas outlets, provided with valves, are situated at top and bottom of the generator. When gas is being generated, it is taken off first at the top of the generator and then at the bottom. The operating mechanism which causes the reversal of these gas outlet valves also controls the steam supply and its regulation and the other parts of the accessory equipment, so that reversal for these is exactly synchronized with reversal of the gas.

#### OPERATING CYCLE FOR THE BLUE-GAS PLANT

The process of making blue-gas consists of heating a bed of coal or coke to a predetermined sufficient degree of incandescence by an air blast through the firebed in the generator, and passing steam through the fuel thus preheated. After the fuel has been made properly incandescent, the steam is blown first up and then down through it until the temperature of the bed has been lowered somewhat. Then the steam is turned off and the fuel bed brought back to incandescence by the air blast.

The period of this cycle and the relative times of its various parts must be changed as required by changes in fuel or other conditions. The cycle found most economical at the Empire Gas & Electric Co. plant occupies 3½ minutes. This is divided into 25 per cent for blow period, 15 per cent for up-run steam, 45 per cent for down-run steam, and 15 per cent for up-run steam, making total of 100 per cent.

#### OPERATION OF BLUE-GAS PLANT

The amount of air used varies with the fuel. The conditions are most favorable to gas making when the fuel bed is kept uniform. This plant has obtained good

The product of the blue-gas plant is not at present accurately known, as it was not the former practice to meter the lean-gas used for heating and there is consequently no meter on the oven fuel-gas mains. It is expected, however, to install such a meter at an early date, and at that time the exact operating economy of the blue-gas can be figured.

#### COMPARISON OF BLUE-GAS AND LEAN OVEN-GAS

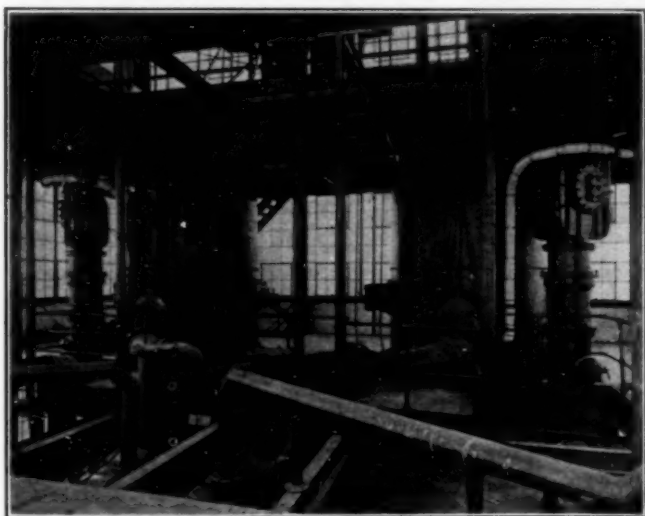
The following is an average analysis of blue gas:

	Per Cent		Per Cent
Carbon monoxide .....	43.5	Oxygen .....	0.6
Hydrogen .....	47.3	Nitrogen .....	4.4
Methane .....	0.7		
Carbon dioxide .....	3.5	Total .....	100.0

The above analysis shows 91.5 per cent of combustibles and 8.5 per cent of inerts. Blue-gas of this analysis requires 2.3 volumes of air for complete



OPERATING FLOOR WITH AUTOMATIC CONTROLS  
AT RIGHT



SECOND FLOOR SHOWING THE TWO GENERATORS  
AND PIPING

results with an air blast of 10,000 cu.ft. per minute. The usual steam pressures are 90 lb. for up-run steam and 95 lb. for down-run steam.

It is the practice to clean the firebeds once each shift, or three times per 24-hour day. This cleaning occupies about 30 minutes, and can be easily accomplished by the coke handlers from the ovens without interfering with their other duties. The fuel is elevated by the same workers that elevate coal to the ovens. It does not require over 2 hours per day to accomplish the handling of sufficient coke to run the generators.

combustion. This gas has a specific gravity of 0.559, a specific heat of 0.45 and a calculated flame temperature of 3,470 deg. F. Its calorific value is 302 B.t.u. per cu.ft.

A usual sample of the lean oven-gas would have an approximate analysis as follows:

	Per Cent		Per Cent
Carbon dioxide .....	1.0	Hydrogen .....	51.9
Illuminants .....	1.4	Nitrogen .....	17.4
Oxygen .....	0.3		
Carbon monoxide .....	1.5	Total .....	100.0
Methane .....	26.5		

This is only a sample analysis of a lean-gas. This gas requires 4.25 volumes of air for complete combustion. Its flame temperature is 4,000 deg. F. Such a gas varies with conditions of carbonization and fluctuations in demand. For this reason it is not feasible to give any constants for lean-gas. The calorific value is found generally to vary between 380 and 450 B.t.u. per cu.ft.

#### CHANGING FROM LEAN-GAS TO BLUE-GAS

One of the interesting points noted in the burning of blue-gas in the oven flues in comparison with lean-gas is that it is a much cleaner fuel. It is also noteworthy that greater operating efficiency is possible because the blue-gas is more constant in quality than the lean-gas.

The adoption of blue-gas as fuel at Empire did not necessitate any changes in burners or equipment on the ovens. The slip blanks which are inserted in the union of the 1½-in. gas lines which feed the flues are



VIEW UNDER GENERATORS SHOWING CLEAN-OUT  
AND ASH CAR

disks with round holes varying in size from 8 mm. diameter for upper flues to 14 mm. diameter for lower flues. These serve to govern the amount of gas admitted to the combustion chambers.

It is interesting to note that the openings in these slip blanks were not enlarged or changed any way in changing to blue-gas fuel. The gas pressure in the fuel-gas line to the oven battery was increased by 3 cm. of kerosene, the amount of air admitted to the gas was reduced, and the stack draft reduced proportionately.

After these adjustments had been made no difficulty whatever was experienced and the heats were maintained without any trouble. There is no formation of soot or carbon in the flues when blue-gas is used, such as occurs when heating with lean oven-gas. This is a decided advantage. A slight disadvantage in the use of blue-gas is that sulphur collects in the burner pipes. This can, however, be readily disposed of by steaming out these pipes about twice a month; and is of no importance when the decided advantages obtained by using blue-gas are considered.

The writer wishes to acknowledge the courtesy of the U.G.I. Contracting Co. in supplying some of the photographs used in connection with this paper.

## New Use for a Tiering Machine in the Chemical Industry

BY MATTHEW WILLIAM POTTS

**T**HE photograph herewith illustrates a new use for a tiering machine in the chemical plant. This machine was designed for and is being used by the Agar Provision Co., of Chicago, Ill.

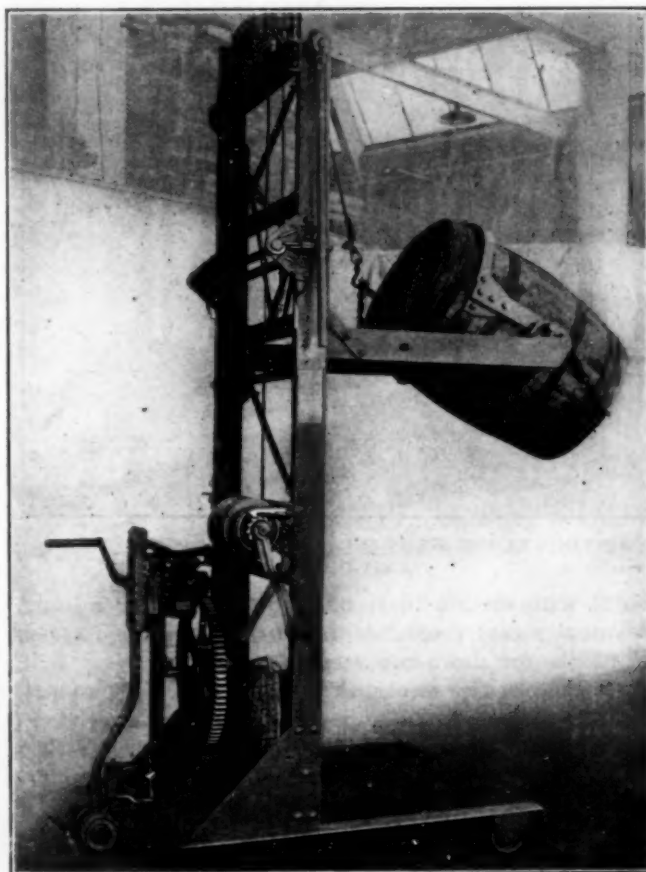
This machine could be used in soap works, perfume and candy factories, packing houses—in fact any place where it is necessary to raise the container before dumping. Many times in passing through a chemical or dye plant, two to four men are seen struggling with a barrel, carboy or drum, trying to raise it so as to dump the contents in to a vat, tank or kettle. If the material being dumped is sticky, the job is made more difficult, as the men have to hold the container while another man scrapes out the contents.

The machine illustrated is portable and can be moved from place to place as easily as a truck. When the pulling or steering handle is in the position shown, the

machine is resting on two feet—one at each corner—which grip the floor and hold the machine firmly in place. There is absolutely no danger of the machine slipping or tipping while the load is being dumped. When the steering handle is brought forward, the steering wheels engage the floor and the two feet are lifted about three-quarters of an inch. The machine can then be moved. When the handle is raised to the vertical position again, the machine is automatically locked to the floor and remains there rigidly fixed until the handle is again drawn forward.

Everything about this machine is standard construction with tiering machine manufacture except the tipping device, which is a special design. The tipping device consists of the machine platform arms, the container cradle or cradles and the small winch mounted on the machine uprights, including its cable and sheave.

The operation of the machine is simple and the machine and one man can do the work that with ordinary hand methods would require two or three men at least. When the machine platform is lowered, the steel cradle ring which holds the barrel rests upon the floor. The barrel is placed within the ring, the platform elevated slightly and two short chains are hooked over the chime of the barrel. The platform is then elevated to the height desired, the barrel being held in an upright position suspended within the ring. The cradle rests on two pivot points that are held in brackets or the platform arms. A chain is fastened to the cradle ring and in turn this chain is fastened to a cable which runs over a sheave and to the small winch mounted on the machine uprights. The barrel can be tipped to any angle or completely over and back, always under absolute control of the operator, by turning the hand crank of the small winch.



TIERING MACHINES FOR TIPPING BARRELS



## Synopsis of Recent Chemical & Metallurgical Literature

### Protection Against Cementation by Direct Application of Coating with a Brush

In the April, 1922, issue of *Revue de Métallurgie* Gailbourg and Ballay present the results of a rather extensive series of experiments upon local case-carburizing.

With the work of Guillet and Bernard as a starting point, they proceed upon the assumption that the best protection against cementation is to be found in a coating which carries copper to a considerable extent. The three methods mentioned for application of copper coatings are the electrolytic, by dropping in solutions of copper salts, and by means of the Schoop spray process. All these processes present some disadvantages in regard to cost, ease of operation, etc.

The authors present a new method of applying a copper coating by one direct application with a brush. At first they experimented with a coating produced by a mixture of resin varnish with copper dust. The results obtained with this coating were not successful and photomicrographs are shown to illustrate this. It is probable that the carbon in the varnish was responsible for part of the cementation.

Sodium silicate was next used as a carrier for the copper dust, equal portions, by weight, of the two being used. The objection to this combination lay in the cost of the copper, so a search was made for some inert material which might serve as a diluent for the copper. Such materials as kaolin, emery dust and iron oxide were used. Emery dust gave the best results. It was thought that possibly aluminum dust might be used in the place of copper, but the experiments wherein this was used indicated that its use was not warranted.

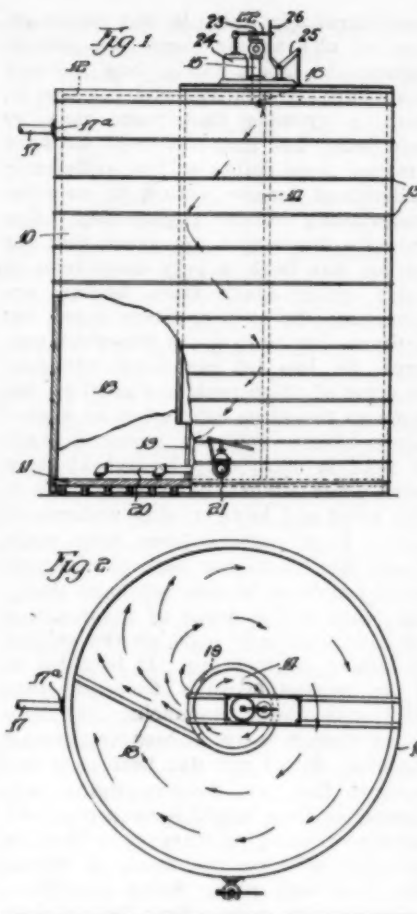
#### THE MIXTURE SELECTED

The mixture which the authors finally selected as being the best bears the following proportions:

Copper powder.....2 parts by weight  
Emery dust.....1 part by weight  
Commercial sodium silicate in sufficient quantity to form a thick paste.

Before applying the coating, the pieces must be freed from all mineral oil, this being accomplished by placing them in an oven at 500 deg. C. A coating of from  $\frac{1}{4}$  to  $\frac{3}{4}$  mm. is necessary to prevent cementation. From 15 minutes to 1 hour is required for the coating to dry. This time depends upon the temperature of the piece when the coating is applied.

The latter part of the article is devoted to a discussion of experiments designed to test the efficiency of copper coatings produced by dipping the articles in copper-bearing solutions.



The most successful solution used bears the following proportions:

$\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  ..... 1 to 2 g.  
HCl ..... 1 c.c.  
Butyl alcohol ..... 100 c.c.

The use of any of these solutions is apparently not unqualifiedly recommended by the authors, for they state in their conclusions that the coatings thus produced do not exhibit any marked superiority over electrolytic coatings.

#### NO PROVISION FOR REMOVAL

It is unfortunate that the authors do not describe a means for removal of the coating consisting of copper, emery powder and sodium silicate, as it is in that respect that most of the coatings of a similar nature have failed. The pure copper coatings do not interfere with any subsequent machining operations, but any coating which involves the use of sodium silicate would have to be removed before machining or grinding.

After a consideration of this work, the question arises as to whether or not the presence of copper is absolutely essential in a protective coating of this nature. Experiments carried out at the University of Michigan<sup>1</sup> have seemed to demonstrate that copper is not essential, good protection being secured by the admixture of asbestos and alumina with sodium silicate.

<sup>1</sup>See "Selective Case-Carburizing," by W. P. Wood and O. W. McMullan, *Chem. & Met. Eng.*, vol. 26, p. 1077 (June 7, 1922).

## Recent Chemical & Metallurgical Patents

### American Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

**Settling Tank.**—Walter H. Green has designed the settling tank shown in the accompanying drawing for the purpose of causing the flow to pass through the maximum travel while within the tank, thus achieving maximum settling with minimum space requirements. As will be noticed from the drawing, the inlet and outlet are both at the top of the tank, and by means of a series of baffles the fluid from which the solid matter is to settle is caused to make the maximum amount of travel while within the tank which is available if the precipitated matter is to be removed from the bottom of the tank. (1,417,516; Walter H. Green, assignor to International Filter Co., May 30, 1922.)

**Fume Control Device.**—In heating and treating industrial materials, especially when of a chemical nature, there is liability of the evolution of fumes possessing flammable or explosive properties. The device covered in this patent is for the purpose of governing these fumes at the time and place of their inception by automatic and simple means which will not interfere with the apparatus with which it is employed. The essential feature of this device is a means for disposing of the fumes in a harmless way should ignition or explosion occur. This is accomplished by having the fumes led directly from the place of generation to a chamber having two exits—a normal exit and an emergency exit. When the normal exit is in use, the emergency is closed, being held so by a fusible link. Should this link melt, due to flame or explosion, the normal exit is closed and the fumes are led through the emergency exit to a place where they can do no damage. (1,414,722; Vern K. Boynton, assignor to Perry & Webster, Inc., May 2, 1922.)

**Blasting Dynamite.**—Blasting dynamite with improved stability and high velocity detonating properties is claimed by Wendell R. Swint in a specification covering the use of smokeless powder and cordite with the usual sodium nitrate and chalk but containing 3 to 15 per cent water.

The smokeless powder and the cordite are ground separately with water, the excess water being removed by centrifuging. The ground smokeless should then contain about 15 per cent water and the cordite 10 per cent water. In this condition they are mixed in the proportion of 28 parts smokeless, 40 parts cordite, 31 parts sodium nitrate and 1 part chalk. (1,411,674; Wendell R. Swint, assignor to E. I. du Pont de Nemours & Co., Apr. 4, 1922.)

## Book Reviews

**THE MANHOOD OF HUMANITY: THE SCIENCE AND ART OF HUMAN ENGINEERING.** By Alfred Korzybski. New York: E. P. Dutton & Co., 1921. 208 pp. (Appendices, III.)

**EDITOR'S NOTE**—The interest displayed among our readers in this book has prompted one of our friends to call our attention to a review of it by Dr. Frankwood E. Williams in *Mental Hygiene*. Dr. Williams is as prominent in his field of endeavor as are the leading chemical and metallurgical engineers in their respective fields. The latter will undoubtedly be deeply interested in the reflections of a physician on the ideas and habits of thought of engineers.

This book has been so much praised—it has been called "epoch making"—that, having finished it and found little of value in it, one wonders if possibly the point of it all has been missed. But on looking through it a second time, it does not seem that the main points have been lost. There are, apparently, three of these, and as they are mentioned in each chapter, not once but several times to the verge of tedium—in fact, the author never seems to get at the real problems of the "science and art of human engineering" because he is so occupied in belaboring his three points—it is impossible to miss them. These points are: (1) Man is not just an animal. (2) Neither is he a combination or union of animal with something supernatural. (3) Man is literally a part of nature and of a different "dimension" than animals. By this latter the author means that man is distinguished by "time-binding qualities"—human beings are "time-binders." (Plants are "chemistry-binders" and animals "space-binders," according to the author.)

The expression "time-binder" is the best contribution the author makes. While there would seem to be nothing new in the conception of "time-binding," the expression itself is a happy one, so rich in imagination that one is surprised to find it in a book on "engineering," praised by engineers and mathematicians, until one remembers that genuine imagination lies rather with the engineer and the mathematician than with the poet and philosopher, as is so commonly supposed.

Count Korzybski is very much in earnest about these three points, and while it does not seem possible that an intelligent person would take serious issue with any one of them, he would seem to feel that the intellectual world is armed to the teeth against them. We have, therefore, not so much a book on the "science and art of human engineering" as a book devoted to proving that man is not just an animal, is not part animal and part su-

pernatural (in fact, is not supernatural at all) and is more than animal because he has a fairly long memory (time-binding quality) and can use it; with a promise that more may be said later, but that not until we have grasped these points will we sufficiently understand human nature to consider undertaking human engineering. One gets the impression, somehow, that the author has been a very busy man in fields quite apart from human engineering—he is a military man, one gathers—but that, as an avocation perhaps, he has let his mind ruminate on some of these problems until he has come to the same conclusion as a good many others—that the greatest study of man is man; only Korzybski stops here while others have pushed from this point and have tried to understand man. It is quite evident that while Count Korzybski has been thinking on these problems he has not been studying them in the sense of ascertaining what data already exist on the subject of human engineering. It is a bit as if an engineer came forward, year 1922, with a book announcing that there is no reason why a heavier-than-air machine should not fly; that it is important that we develop flying machines, as they would have a use both commercial and military; and that he believes he is on the track of principles that will make flying possible—evidently not aware that the Wright brothers flew 18 years ago and that there has been considerable successful experimentation and development of airplanes since.

The general practitioner of medicine, and the layman, frequently complain that the psychiatrist uses a language—a "jargon" they call it when something eludes them—that they cannot understand. They seem to feel that something is being kept from them, that somehow it should all be made a little easier for them. They are not altogether wrong in this, although they forget that every profession, even every occupation or trade, has its own specialized vocabulary; that the reasons for this vocabulary are definite and important and even apparent, if one stops to think, and that one cannot expect to understand technical matters of law, or architecture, or bookkeeping, or farming, or the teaching of English, without first becoming acquainted with some of the special terms commonly used. One can imagine an engineer, for example, frowning at the technical terms in Paton's "Human Behavior"—why does the man hide behind these words? It is interesting to see, therefore, how simply things can be stated for the engineer. Here, for example, is Germany mobilized:

"... a state is the governing center of an accumulation of human beings—of time-binding powers—increasing exponential functions of time. These powers, though the same in kind, differ in degree and in respect of individuality. If they are to be united so

as to constitute a whole, they must be given a common aim; they must, so to speak, be reduced to a common base; if they be respectively  $X^m$ ,  $Y^n$ ,  $Z^p$ , and so on, we cannot unite them and compute the whole by adding the exponents; but if we give them a common base—a common aim or purpose—then we can readily represent the magnitudes of the whole constituted by them; if we take  $X$  to be their common aim or base, then, if  $Y$  equals  $aX$ ,  $Z$  equals  $bX$ , and so on, we shall have:

$$X^m Y^n Z^p \dots = X^m a^m X^n b^n X^p \dots \\ = (a^n b^p \dots) X^{m+n+p \dots}$$

"The last expression, where the parenthetical coefficient is the product of individualities, serves to represent the united powers of all in terms of  $X$ , the common base, purpose or aim."

In addition to the contribution of the terms "time-binder," Count Korzybski's book will probably be useful in another way. If the book arouses interest in the science and art of human engineering on the part of the president of the International Rotary Club, the vice-president of the Association of Mechanical Engineers, eminent consulting engineers and the professors of mathematics at Columbia and elsewhere (all quoted as praising it), it will be the most useful book on the subject yet printed. And if, their interest stimulated, these business men, engineers and mathematicians wish to continue their studies, they might begin with—a number of books come to mind, but, for example, White's Foundations of Psychiatry.

FRANKWOOD E. WILLIAMS.

The National Committee for  
for Mental Hygiene.

**MANUFACTURING COSTS AND ACCOUNTS.** By A. Hamilton Church, consulting industrial engineer. First Edition. New York: McGraw-Hill Book Co., Inc. 450 pp. Price \$6.

The author has aimed in this book to present a simple view of the general structure of cost accounts and to introduce gradually to the student the underlying principles on which manufacturing accounting of all kinds must rest. The relation of the cost accountant's work to the general accounts is clearly shown and to the general accountant the peculiar value of detail to the cost man has been emphasized.

The book is divided into three parts. Part I presents the general outline of manufacturing accounts; Part II covers cost accounting; Part III shows the factory reports and returns.

The mechanism of accounting is explained in detail with the aid of symbols and diagrams. By these diagrams, quantities and values are shown flowing from the purchase and cash journals to the ledger accounts and from these through the burden and manufacturing journals to the burden and manufacturing accounts, the burden account being later transferred to the manufacturing account. The methods of connecting expenditure incurred in manu-



facturing with individual quantities of product are presented fully. The selection of an appropriate cost system is shown to be governed by three main conditions:

1. The method in which direct labor and expense are applied to the product.
2. The unit quantity of product selected for costing.
3. The degree of detail required in the costing of this unit quantity.

The major portion of the book is devoted to the explanation of the three methods (A, B and C) of charging expense to the product after the amount of burden applicable to each department has been determined by taking into account the amount of equipment, internal expense and the proration of the expense departments on some basis that implies measuring the cost of service as each department has received it.

In Method A the expense is merged and averaged with Direct Labor, and charged to unit quantity of production on a time basis, the material being charged direct to individual orders. This method of costing requires that there be no substantial difference in wage rates between operatives engaged in any one department or performing any one operation and that all product has the same and entire series of operations. Consequently this method of connecting labor and expense with output is limited to homogeneous products.

Method B averages Expense and charges it to Orders in proportion to direct labor or labor hours. Labor and material are charged direct to the orders. Although the most widespread of all methods of costing, it has the disadvantage of being more or less incorrect due to the fact that it is seldom true that all machines used in production are of the same cost, occupy the same space, take the same power or entail the same supervision. If expense is very small compared with labor and material, this approximate method will cause no great harm, but on account of its "simplicity" is unfortunately applied in shops where expense may be many times the direct wages. Piece-work, premium or bonus wage systems may be used. For hand industries this method is quite satisfactory.

Method C is the "machine hour rate" in which normal expense is divided into factors which are allocated among different machines on a basis determined by the contribution of each factor to the running of each machine. The total found allocated against each machine divided by the number of working hours in the period for which the calculation has been made gives an hourly machine rate. By this method the cost of idle machines can be ascertained and investigations made to determine cause and apply the correct remedy. This cost of idle machines can be written off to Profit and Loss or applied as a supplementary rate to Production Orders, especially if the industry is in a position to recover this wasted capacity in the selling price of its products. In either case the amount is a barometer of the cost of non-production caused by

conditions of trade or more often by poor management. The author, who was among the first to introduce the "machine hour" method of distributing expense, gives detailed methods of determining the correct production factors and hourly rates.

The author has devoted several chapters to purchasing and stores, time and pay, production and standing orders, and the preparation of cost sheets. Sample forms have been profusely used to make the subjects clear to the reader. The chapter on standing orders shows a very complete system for collecting expense in intelligible forms.

Under "Factory Reports and Returns" the author emphasizes the fact that the cost system to be satisfactory must furnish an aid to efficient management and production as well as obtain figures and statistics as to the financial condition of the business. The shop wants its data "red hot," while the higher officials desire information more general in type but with clearer and more systematic grouping and presentation. The reports for foremen, superintendents, executives and proprietors are clearly indicated and their derivation from various parts of the cost system shown.

With the fundamental information contained in this book the student should have no difficulty in applying cost sense to the particular problems that may be met.

WILLIAM B. TODD.

**CANE SUGAR.** By Noel Deerr. Second (Revised and Enlarged) Edition. London: Norman Rodger. New York: D. Van Nostrand Co. 644 pp., 30 plates (12 colored), and 360 illustrations in the text. 1921. Price \$10.

A standard reference book! Think for a minute what this means. Then consider the sugar chemist, engineer and plantation manager—nobody realizes better than these men themselves when far away from the city library and in the midst of the sugar-making campaign how much they need an authoritative, complete and up-to-date reference book covering every phase of the sugar industry. Such a book is "Cane Sugar," by Noel Deerr.

When the Sugar Chemists and Technologists tendered Noel Deerr a farewell banquet in New York on Sept. 30, 1920, Dr. C. A. Browne as toastmaster remarked that Mr. Deerr's chemical and technological attainments placed him foremost among the cane sugar experts of the day, and also stated that with his departure America was losing the man who had the greatest bibliographical knowledge of the works and publications on sugar in the libraries of her great cities. Regret was expressed that Mr. Deerr's departure prevented the realization of his plan to compile a much-needed bibliography of the works and references pertaining to the botany, history, agriculture, chemistry and technology of sugar and the sugar cane.

If indeed regret must be expressed

that the author's bibliographical work lacks somewhat of being fully complete, the reviewer feels that this loss has been compensated in great degree by the very excellent summations of the literature and the inclusion of the most important references. Each chapter of this book is appended by a list of references to the literature and patents cited which adds greatly to the value of the work as a whole.

In addition to the lists of journal articles and patents to which reference is made in the text, the edition is appended by a very complete bibliography, the various works being arranged for convenience under the following headings: Older Monographs; Works on Travel, Histories, etc.; Encyclopædias and Dictionaries; Works Dealing With History and Commerce; Works Dealing With the Agriculture of the Cane; Books Dealing With Sugar Manufacture; Works on Analysis and Chemical Control; Works Specialized on Steam and Engineering; Books Dealing With the Chemistry of the Sugars; Books Dealing With Pests and Diseases; Works on Filtration; Works on Rum; Bibliographies; Various Unclassified Works.

An interesting historical conspectus traces the progress of the industry from 327 B.C. to the beginning of the Great War in 1914.

The author has arranged the chapters of this textbook into three parts. Part I deals with the agriculture of the sugar cane, Part II with the manufacture of cane sugar and Part III with the analysis of sugar-house products.

In Part I are included chapters on the composition of the sugar cane, description of cane varieties, classification and discussion of soils, cultivation, manuring, diseases and pests, and harvesting.

The second part begins by discussing the extraction of the juice by mills, and traces the process of manufacture to sugar in the bag and disposal of molasses and bagasse. The chapters in this section are entitled Extraction of the Juice by Mills; Diffusion Process; Action of Heat, Alkalis and Acids on Sugar and Cane Juices; Defecation of Cane Juice; Carbonation Processes; Sulphitation; Filtration; Evaporation; Sugar Boiling and Crystallization-in-Motion; Separation of the Crystals; Molasses; and Bagasse as Fuel.

In the third part the author describes the polarimeter, methods for determining cane sugar and reducing sugars, the assay of sugar-house products, and the chemical control of the factory.

An additional chapter is devoted to fermentation, with special reference to the sugar-house and to the fermentation of molasses.

The value of the book as a whole may be attributed to the fact that the subject matter is discussed from both theoretical and practical standpoints, by a man "who has his head up and both feet on the ground." An experience of 25 years is back of it.

Although much of the data is pre-

sented in chronological order tracing technical progress, the various merits and imperfections in types of equipment and advantages and disadvantages of different practices are discussed in such a way that the reader may easily follow the advances in the industry and thereby acquire a sounder and more rational idea of the "reason why" of present practice. At the same time, however, questionable present-day practices which must be further investigated before universal acceptance are dispassionately treated of from the open-minded viewpoint.

As a text and reference book "Cane Sugar" surely calls for no adverse criticism. It is all good. Certain subjects to be sure are treated of more comprehensively elsewhere, but in covering the field so broadly in one volume the author has done well to condense and summarize. To single out minor points for criticism would be superficial in the extreme and would detract none at all from the value of the book to those for whom the author has written it.

C. F. WALTON.

**AN OUTLINE OF QUALITATIVE ANALYSIS OF INORGANIC SUBSTANCES, INCLUDING THE RARE ELEMENTS.** By *Horace G. Byers*. New York: D. Van Nostrand Co. 227 pp. Price, \$2.

The book is planned to serve as a guide in courses in which qualitative analysis is presented as a laboratory course to accompany lectures in the general chemistry of the metals. It represents the result of over 20 years' experience in teaching general chemistry and qualitative analysis. Part I "is essentially a syllabus of lectures" upon the procedure and theories of qualitative analysis. In the early pages of this part the purposes, ideals and necessary precautions are set forth in a clear and inviting fashion. It is evident that at the start the author has had in mind the perplexities of the beginner. But one can scarcely help wondering if he has not forgotten the limitations of his students when in discussing the theories of solution he attempts to summarize in brief sentences the divergent views of van't Hoff, Jones, Werner and Kahlenberg, and then harmonize them all in a theory of his own for which he says "he is not able to secure adequate experimental evidence." Would it not be better to select the best of the current theories for the beginner and leave the discussion of the merits and weaknesses of conflicting theories to an advanced class in analytical chemistry or to a graduate seminar? Many teachers will prefer, also, to leave their qualitative students in ignorance of the Lewis-Langmuir theory rather than to be content with the statement that "this theory is not such as may be summarized simply and the student is referred to the original articles. . . ."

Anion analysis precedes the analysis of the metallic ions because in the opinion of the author "there seems to be no

logical reason against this order and some very good reasons for it." Not all teachers will agree with him on this point. The methods of identification are "conventional," and the presentation is admirably made. The section on systematic analysis is clear and so well arranged that a student should be quite independent. In a few places he will need help, as for instance when he attempts to get an alloy containing tin into solution with boiling concentrated nitric acid (p. 129), or when he attempts to remove phosphates in the absence of iron (Table VII, p. 150).

The most characteristic portion of the book is Part V, which is devoted to the detection of the rare elements. No attempt is made "to provide a comprehensive treatment of these elements, but rather an outline of the procedures by means of which their presence may be recognized and the means of identification; at least so far as to enable the student to know when he should consult larger texts." The general plan of procedure used in the analysis of the common elements is followed. The presence of rare elements produces certain peculiarities in the preliminary examination, the interpretation of which is given in tabular form. The individual rare elements are grouped according to the usual five metallic groups and characteristic reactions are given for most of the elements. The analysis of each group follows the general scheme, but there are few attempts made to correlate the analysis of the rare elements with that of the more common ones. Frequent references are made to larger works where more detailed information is available.

The appendix contains much useful information for both teacher and student. A more extended table of solubilities would have been welcomed by many. Only a few typographical errors are observable, such as the production of  $\text{SnCl}_2$  by action of  $\text{HCl}$  on  $\text{SnS}_2$  (Table V, p. 148).

The book shows clearly the wide experience of its author. It will be very useful, especially to the rapidly increasing number of chemists who desire accurate information concerning the qualitative analysis of the less common elements.

B. S. HOPKINS.

**REVIEW OF PAPERS ON ELECTRODEPOSITION AND ELECTROPLATING.** Transactions of the Faraday Society, vol. 16, Part 3, July 1, 1921.

The several papers presented in this book are of much interest and they, along with the discussion, give the opportunity of obtaining a "close-up" of the electroplating industry in England. As a whole the papers are excellent. There is evidence of a great deal of hard, conscientious work by each author. The amount of data given is proof of the desire to give the details that are so essential to a clear conception of the author's opinions.

The discussion is remarkably frank

and the reviewer is left very little to do, so thoroughly has each paper been criticized. "The papers should be read by every one interested in electrodeposition of metals. While there are points upon which entire agreement will not be possible, it must be admitted that in general they are the best that has so far been published in any one volume. The progress of electroplating seems to have been greater in this country than in England. The commercial application for ornament and protection of metals is done on a larger scale and more study has been given to details.

Dr. F. C. Thompson at the beginning of the discussion very truly states: "I have only one other thing that I should like to say, and that is that in some respects the present meeting is undoubtedly an historical one. In America and on the Continent a great deal more attention appears to have been paid to the problem than has been the case in this country, and the Faraday Society, in bringing together the large number of papers which have been presented at this meeting, has done something which has never before been attempted, to my knowledge, in this country."

We say that such meetings bring all interested in electrodeposition closer together. Let there be more of them. Better still, why not have a joint meeting of the Faraday Society and the American Electrochemical Society and have a session devoted to the electrodeposition of metals?

GEORGE B. HOGABOOM.

**DYES CLASSIFIED BY INTERMEDIATES.** By *R. Norris Shreve*, in collaboration with *Warren N. Watson* and *A. R. Willis*, Chemists, U. S. Tariff Commission. New York: Chem. Catalog Co., Inc. 8vo, 631 pp. Price, \$10.

In the opinion of the reviewer, the authors have rendered a very valuable service to the cause of American dye chemistry in the compilation of this classification, for after all the intermediate is the more important factor in a modern dye plant, since from it not one but many dyes may be manufactured, and nowhere is this more clearly or more compactly exhibited than in the publication under review.

The plan of the work is set forth in the Introduction (pp. 7-15), which includes also a brief description of the system of nomenclature used by *Chemical Abstracts* and its relation to other systems in vogue today.

Part I, Intermediates and Dye Tables (pp. 17-581), constitutes the body of the book, and is composed mainly of an alphabetical list of intermediates. The various names by which these different intermediates are known appear each in their appropriate alphabetical place, but the dye tables and other data are given under but one of these synonyms, all the others being referred to this principal name. In some cases, the *Chemical Abstracts* designation is given the preference, in others



the common trade term is chosen as principal name. After each preferred title appear first its synonyms, then the constitution and molecular formulas of the compound, its molecular weight, a condensed outline of its method of preparation, a citation of the pages in standard reference works where further information can be found, and a tabular statement of dyes produced from it giving Schultz number of the dye, its ordinary trade name and class (structural), statistics of importation and manufacture for the United States, other intermediates employed with it for the preparation of the dyes listed, pertinent notes, and dye application class. Under aniline, for example, appear 104 different dyes, under benzidine 88, under H acid 41, etc. Each dye appears under each of its intermediates.

The list of intermediates and dyes is followed by a Formula Index of the 487 intermediates recorded, the molecular formulas being arranged as in the formula indexes of *Chemical Abstracts*, and each formula being followed by the principal name of the intermediate and a reference to the page whereon it is described. With this Index and the *Chemical Abstracts* name given after each intermediate, reference to the volumes and the index of *Chemical Abstracts* is easy.

In addition, the authors have given a very extensive Glossary of Dye Names (about 5,000), wherein they have endeavored to record the trade names of the better known commercial brands, noting the name of the manufacturer and appending the correct Schultz number wherever possible. This glossary is based largely upon the list given in the index of Norton's "Artificial Dyestuffs Used in the United States."

The book concludes with a Page Index of Schultz Numbers for Dyes, so that knowing the Schultz number the reader can locate at once the page or pages whereon the dye will be found tabulated.

Although in the dyes listed under each intermediate but one of its various names is assigned to each individual dye, there will be no difficulty in locating it through the use of the glossary and Schultz index mentioned. No worker in this field, be he manufacturer, investigator or teacher, can afford to be without this volume, and he should be grateful to those whose labor has made this mine of useful information available in such compact and serviceable form. Were it practicable, in future editions, to add also data showing the uses to which these same intermediates are put in the manufacture of drugs, perfumes, photographic chemicals explosives, toxic gases, incendiaries, signal flares, synthetic plastics, synthetic tannins, etc., those responsible for framing legislation which will protect adequately the dye industry could see at a glance its widespread and far-reaching ramifications and the vital part it plays in

the life of the individual citizen and of the state in our present civilization.

The book is clearly printed upon good paper, with remarkably few typographical errors for so difficult a composition, and makes a most attractive volume in its dark red buckram binding.

MARSTON TAYLOR BOGERT.

THE ELECTRIC FURNACE. By J. N. Pring, M.B.E., D.Sc. 485 pages, illustrated. New York: Longmans, Green & Co. Price \$10.50.

A really satisfactory text book dealing with the electric furnace is a publication that is much to be desired. The electric furnace has now become a commercial apparatus that is applicable to a great variety of uses, while at the same time it is a most valuable tool in many fields of experimental work. It is not easy, however, to find the man who is qualified to treat the subject as it deserves. It would obviously be impossible to find anyone who had experience with all the electric furnaces that are used or even with a considerable percentage of them; but the author of a text book should at least have had intimate experience with some of the varieties of experimental furnaces and with some representative examples of commercial furnaces used for the different purposes where the electric furnace is the best or the only suitable apparatus. Unless he has this first hand knowledge of the subject, his text book, compiled from the large and highly diversified literature on the subject, is apt to be unsatisfactory to the reader who himself has a practical knowledge of some branch of electrothermics, and actually misleading for the reader who is altogether unfamiliar with electric furnaces.

The task that Mr. Pring has set himself in his book appears to be set forth in this paragraph from his preface:

"The most noteworthy branches of electrochemical and electrometallurgical industry have, within the last decade, been described in a number of publications. Nevertheless, the present rapid progress of these enterprises demands a frequent revision and extension of the literature of this subject as contained in the textbooks. No apology is needed therefore for the attempt, at this stage, to introduce an additional contribution to the general technical discussion of the position and prospects of high-temperature industrial chemistry."

One of the most important uses of the electric furnace is in the production of ferro-alloys, and yet the space devoted to it in this work is only ten pages while eighty pages are devoted to the electric steel furnace. Now, important as is the use of the electric furnace in the manufacture of steel, there appears to be a lack of balance in a text book forming one in a series of "Monographs on Industrial Chemistry" which devotes eight times as much

space to that subject as to the production of the numerous ferro-alloys, products of the electric furnace and of the electric furnace alone. No doubt the excuse for this is to be found in the great quantity of advertising matter, exploiting various kinds of electric steel furnaces, with which we are flooded as compared with the shrinking modesty displayed by those interested in selling ferrous and non-ferrous alloys.

As to the revision of the current text books, it is regrettable that this has not been more thorough, because the inclusion of obsolete or incorrect information not only crowds out useful matter but is misleading to the uninitiated. For example, it is unfortunate that data, quoted from Borchers, dealing with the permissible current density in carbon electrodes, should appear on page 391, from which it seems that 64 amperes per square inch may be used in a rod 2 in. in diameter, but only 10.7 amperes per square inch in a rod 16 in. in diameter; therefore, "it is usually found preferable to build up the larger electrodes from a bundle of smaller rods."

It is because of such lapses as this and the lack of balance in the space devoted to various uses of the electric furnaces that one is led to the conclusion that the author's practical experience with furnaces is not wide enough to qualify him to write that ideal text book referred to above. In spite of these faults, however, it may be said that Mr. Pring has been successful in making "an additional contribution" to the text books dealing with electric furnaces that will be of use to those interested in the "general technical discussions of the position and prospects of high-temperature industrial chemistry."

After a brief historical sketch the author has an interesting section on laboratory furnaces followed by two good sections on current supply and transformers. In the latter chapter he does not describe the induction regulator, a valuable apparatus where uniform variation in voltage is required. In section 10 the electric smelting of iron ores is treated. In the description of the Swedish work on this problem the relation of it to Dr. Heroult's experiments at Sault Ste. Marie for the Canadian Government is not brought out. It is a pity that the work done with synthetic pig iron during the war is not discussed. In treating of the electric metallurgy of zinc it is a little difficult to understand why space should be devoted to hydrometallurgical methods, as the book professes to treat only of electric furnaces. Section 22, on the design of electrode terminals, is rather weak so far as practice in this country is concerned. The inclusion of a section on waterpower developments and steam-power stations is a good idea, and the bibliography which appears as Appendix B is decidedly useful.

F. A. J. FITZGERALD.

## Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields—Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

### Chemical Foundation Plans Fight to Finish Against Return of Patent Rights

General Uncertainty Prevails as to Real Significance of Move, While Speculations of Political Play and German Propaganda Are Rife

IF THE Alien Property Custodian secures the return of the patents and other rights purchased by the Chemical Foundation, it will be only after the Foundation has exhausted every legal recourse in its effort to retain them. The position of the Foundation is that the President must have been misled. It is believed, however, that the detailed study of the whole transaction, which will have to be made in connection with the court actions which will be taken, will reveal to the satisfaction of the administration as well as to others interested in the establishment of a domestic chemical industry that no organization could have more altruistic and patriotic objectives.

There is no tendency to charge ulterior motives to any of the administration officials involved. It is very generally believed that their action is based on the very plausible case which has been built up by those interested. The opinion is expressed that the Attorney General, smarting under the attacks which have been made on him, rather welcomes any action which may serve as a smoke screen and divert from him some of the objectionable attention which he has been receiving.

#### BITTER FIGHT EXPECTED

The fight over the Chemical Foundation purchases promises to be a particularly bitter one. Some of the friends of the Foundation are condemning the administration's action in a most unqualified way and declare that the special representatives of the German chemical industry must be fast workers as they have been in the country for only four weeks. For the most part, however, those particularly interested in the building up of a domestic chemical industry are making no charges of untoward influencing of officials by German interests. They point out that political expediency hardly could have prompted the move since it is certain to be unpopular to restore to former enemy aliens property which will deprive the American people of great benefits. Perhaps the best example of a benefit which the public is receiving is shown in the case of the salvarsan patent. Whereas the price per dose was maintained at \$4.50 as long as the patent was in German hands, a more uniform product is now available for \$1.50 per dose.

The Foundation has applied this policy to all of the patents under its control.

While it has been known for some months that an informal investigation of the Chemical Foundation has been in progress, at no time has the Foundation been called upon for information of any character. It is for this reason that many conclude that the Alien Property Custodian has been informed of one side of the case only.

#### ATTACK ON FOUNDATION LATE

In connection with the demand for the return of the patents held by the Chemical Foundation, it will be recalled that this organization was not formed until after every effort had been made to find a way whereby these patents could be turned over to a governmental agency. Mr. Garvan in testimony before the Ways and Means Committee in 1919 and before the Senate Finance Committee in 1920 expressed willingness to turn the patents over to any governmental agency and urged the Committees to make suggestions as to how that could be done. No suggestion has been forthcoming from either Committee.

#### Harding Letter Demands Return of Patents

The text of President Harding's letter to Thomas W. Miller, Alien Property Custodian, ordering the return of the patents transferred to the Chemical Foundation under the previous administration follows:

My dear Colonel Miller:

My attention has been called by the Department of Justice to the fact that a corporation known as the Chemical Foundation has brought suit against the Treasurer of the United States and certain licensees of the Federal Trade Commission for an accounting alleged to be due the said Chemical Foundation on royalties due it for the use of certain patents originally seized under the authority of the Alien Property Custodian and sold to the Chemical Foundation by the Custodian during the previous administration. On the face of such an action it became so apparent to me that an inquiry should be made, that I asked for a report by the Department of Justice on the sale of this enemy property to the Chemical Foundation. It appears that the sale was

#### Government Institutes Criminal Proceedings

Criminal proceedings against the Chemical Foundation were begun on Saturday by Attorney General Daugherty and a subpoena was served on Francis P. Garvan, President of the Foundation, calling for immediate production of all of the Foundation's books and papers before a Federal Grand jury in Washington, D. C. The decision to conduct a criminal investigation instead of a civil suit was a complete surprise to Mr. Garvan, who was at a loss to account for this move on the part of the government.

made at so nearly a nominal sum that there is reason to believe that this government has not faithfully observed the trust which was implied in the seizure of this property. The circumstances relating to the entire transaction are of such a character that full investigation becomes a public duty. Moreover, I feel that your office is obligated to maintain the sacred character of the trust to which the Alien Property Custodian is committed by the law.

You are therefore directed to forthwith proceed as follows:

1. Make written demand upon the Chemical Foundation, Inc., in form to be approved by the Attorney General, to immediately return, transfer and assign to the Alien Property Custodian, all patents, trademarks, copyrights, contracts, applications or other properties or rights transferred to it by the Alien Property Custodian as aforesaid, and to account to you for any and all rents, profits, license fees, or other proceeds thereof realized by said Chemical Foundation, Inc., from said properties, or rights or any of them, from the date of transfer thereof to the Chemical Foundation, Inc., to the date of restitution.

2. Take any other action which may be advised or approved by the Attorney General, by suit or otherwise, to fully and in every respect protect the rights or interests of the United States and any other person or corporation interested therein, in and to the properties and rights aforesaid, and any proceeds, income or profits therefrom in the hands of the Chemical Foundation, Inc., or its officers, agents or employees.

In carrying out these instructions you will act upon the advice of the Attorney General.

Very truly yours,

WARREN G. HARDING.



## Garvan Charges German Intrigue in Demand on Chemical Foundation

**Rescission of Sale of Chemical Patents to Chemical Foundation Is Attributed to the Scheming of German Cartel's Representatives**

**D**EFIANCE to the government's demand for the return of the 4,700 German patents held by the Chemical Foundation, Inc., and a strong insistence that this action is the result of German intrigue are the outstanding notes in the several statements issued by the Foundation's president, Francis P. Garvan. This official, on receipt of the first news of the President's letter declared that "this action was taken without any notice to the American organic chemical industry or to the Chemical Foundation or any of its officers or to, in fact, anyone equipped to speak for this essential American industry in peace and war. It has been begun I am informed after a full hearing by the representatives of the German Cartel, the German Dye Trust and the German Government without any American interest being given an opportunity to be heard in reply."

Mr. Garvan maintained that it was these "powerful friends at court" who had aided in the scheme to regain control of the American organic chemical industry, which had been lost to the Germans during the war. The return of these patents was a necessary step in the German program for the following reasons:

They know that the upbuilding of German industry to the point already visioned by the industrious and ambitious German mind, is, if not impossible, rendered extremely difficult by American possession of the patents of this basic industry.

They know that unless they can strangle American competition now the American organic chemical industry soon will be too solidly established to be affected by German competition—under any reasonable form of protection.

"They know that if the American organic chemical industry can be wrenched loose from the Chemical Foundation it can be attacked piecemeal and destroyed, the patents, of course, reverting to their former German owners, spies and enemy aliens."

### GERMAN LAWYERS IN WASHINGTON

The actual workings of this intrigue were discussed in a statement which Mr. Garvan made to the press on July 7, in which he outlined two significant developments.

1. Within about three weeks a commission, consisting of three German lawyers, Rudolph Oppenheim, Hans Wagner and Karl Holderman, representing the German Cartel, which in turn consists of all the organic chemical industry of Germany, arrived in this country to perfect plans for the recovery by Germany of their control in America of the organic chemical industry. On Saturday, June 24, a conference was held at the office of O'Gorman, Battle, Vandiver & Levy, of 37 Wall St.,

at which were present Mr. Vandiver and Mr. Levy, representing Herman A. Metz, the leading German importer and agent of the "I. G.," and several other lawyers representing the German Embassy and other German interests. It was there decided that a direct action by Germany or by the Cartel to upset the sale to the Foundation would be inexpedient, but that the most promising form of procedure would be to attempt to induce the United States Government to bring the action and to offer to the Government all possible German assistance. Accordingly, a committee was appointed consisting of Messrs. Oppenheim and Wagner, Vandiver and Levy to go to Washington and consult with the Department of Justice.

2. On Tuesday, June 7, this committee visited the Attorney General's office and there placed before his assistants the German proposition and offered German assistance. Prior to that time neither the Chemical Foundation nor anyone in any way representing them nor anyone representing any part of the American organic chemical industry had been asked any question in reference to the sale and subsequent to the visit of the German representatives no request or opportunity was given to any American interests to answer the German representatives before the announcement of the intended demand was made.

### OTHER PATENTS INVOLVED

The demand on the Chemical Foundation naturally raises the question as to whether the case will become a precedent governing other patents sold by the government. In answer to this question, Mr. Garvan declared that the demand would involve: "First, the sale of all wireless patents and plans to the United States government 'for the nominal sum of \$140,000.' Germany had obtained the domination in this country through a patent system similar to the chemical patent system and to free the country from that control they were all sold to the Government for what, of course, is an inadequate price if you consider the value to Germany of the control of the wireless news of the world.

"Second, some 5,700 German patents were selected by the Army and Navy as having been taken out by the Germans to control our freedom in waging war. These patents covered gun sights and countless other appliances and devices either used by our army or navy or which might be used in the future. Many of them had been infringed upon by the army and navy in the winning of the war. The Alien Property Custodian turned over to the United States all the German rights and interests as between this Government and German interests to the navy

for the nominal sum of \$100,000. This transaction will also have to be upset."

### ADMINISTRATION'S MOTIVES

The President's letter does not specify the purpose to which the patents are to be devoted, assuming, of course, that the proposed proceedings result in forcing the rescission of their sale to the Chemical Foundation. The latter, however, points out that it means the ultimate return to the original German owners since any plan for resale or relicensing by the Government would not be in harmony with our treaty of peace with Germany and Austria.

## Charges Met By Counter-Charges

Late Saturday afternoon officials of the Department of Justice voiced a denial of the intimation by Francis P. Garvan that the President's demand for the return of the Chemical Foundation's patents was predicated on information given to the government by lawyers representing the German Cartel. Their conferences in the offices of the Attorney General, it was claimed, were solely in connection with the filing of suits, which had nothing to do with Chemical Foundation matters.

The Government's statement also pointed out that the Department of Justice had decided that the 67 suits instituted by the Chemical Foundation to recover royalties held by the U. S. Treasury might best be handled in the form of one suit in which the government would be the plaintiff instead of the defendant. Another significant statement made by the Department of Justice was that "the return of these patents to the Alien Property Custodian would in no sense benefit their former German owners or interests. The action taken by the Government has been wholly in the interest of the Government itself. The disposition of these patents after their return to the Alien Property Custodian, as well as all alien property held by him must be determined by action of Congress."

### GARVAN'S REFUTATION

In another long statement issued by the Chemical Foundation, Mr. Garvan replies to the Department of Justice and makes the further charge that its only investigation of the Foundation "was initiated and has been under the direction of Gaston B. Means or Z-13, as he was known during the period when he served Germany under Captain Boy-Ed." He also demanded the "secret" report made to President Harding be made public in order that opportunity might be given to scrutinize the motives behind the government's action.

The refutation of the government's charges are contained in the following paragraphs from Mr. Garvan's statement.

The naïve explanation of the visits of the representatives of the German Cartel to this country and to the Department of Justice is false. The Germans have had able

lawyers in this country ever since the armistice, and any boy clerk in the office of these attorneys could have attended to the simple filing of these accounting proceedings.

I repeat that the German commission stated that Germany deemed it injudicious for it to attack the title of the Chemical Foundation direct, and that they then urged that these gentlemen in the Attorney General's office persuade the Attorney General and the President to authorize that action and proffered to them all the assistance they could give.

One last falsehood I wish to answer in the anonymous statement issued yesterday. It stated, "It was pointed out that the return of these patents to the Alien Property Custodian would in no sense benefit their former German owners or interests." This statement is also false. No one had ever suggested, so far as I know, that it was the intention of the Government to keep this German property beyond the day when they had satisfied the claims of injured Americans.

The peace treaty with Germany, according to the instructions of the Alien Property Custodian and the Attorney General, ended the Alien Property Custodian's power of sale. They can, therefore, only be held until such time as some arrangement has been made for the securing of American claims, when they must be returned to the German Cartel.

That such action is being contemplated by Congress is evidenced by the fact that Representative Woodruff recently introduced a bill providing for the return to former owners of all German property not exceeding \$10,000 in value.

### Financial Statement Shows Loss by Foundation

The certified financial statement of the Chemical Foundation submitted in connection with the Shortridge investigation of the dye industry, shows that since its inception in 1919 the Foundation has been operated at a loss of approximately \$200,000.

Although the Foundation has received an income of \$429,649 it has spent \$629,931, of which \$264,017 was for "educational literature and pamphlets," \$151,268 for office salaries, \$84,512 for rent, organization expenses, etc., \$43,133 for legal fees in connection with its patents and \$26,357 for "general literature and pamphlets."

Over half of the total income, or approximately \$245,000, was received from foreign manufacturers importing into the United States products on which the Foundation controlled patents.

It is of interest to know that of the nearly 5,000 patents held by the Chemical Foundation, only 241 have ever paid any royalty. Of these, 31 have paid 67 per cent of the total royalty, 14 have paid 13.8 per cent, 14 have paid 7.2 per cent and 6 have paid 4.2 per cent. In other words, 65 of the 4,802 patents have paid 92.4 per cent of the total income.

### Chemical Foundation Activities Cover Wide Range of Utility

In connection with President Harding's demand for the return to the Alien Property Custodian of all patents, trademarks, contracts and other rights by the Chemical Foundation, it is of interest to note the activities in which that organization is engaged.

The primary purpose of the Chemical Foundation is to build up a domestic chemical industry with particular reference to its application to national defense and to the pharmaceutical and medicinal side of the industry. To secure the coal-tar medicinals, it is necessary to have a dye industry, since many medicines could be obtained only at prohibitive expense if they were not developed as byproducts of dye making.

In its efforts to encourage chemical development in the United States, the Chemical Foundation agreed to furnish \$25,000 for use this year by the American Chemical Society for the publication of scientific literature. This action was taken when the decrease in receipts of the American Chemical Society made it necessary to reduce the amount of scientific literature it had been publishing.

The Foundation is furnishing \$10,000 this year for the National Research Council with which a complete chemical survey has been started. Information is being gathered as to chemical personnel and as to the particular research problems in which the different laboratories are engaging. The survey also includes the compiling of a bibliography of certain chemical subjects and the listing of information with regard to scientific apparatus and chemical supplies.

Another survey being made by the Chemical Foundation has as its objectives the pointing out to individual states the possibilities of developing chemical industries to utilize resources now undeveloped or only partly developed. This survey includes a program for the elimination of waste and the development of chemical byproducts.

Through a co-operative agreement with the Department of Agriculture, the Chemical Foundation is furnishing the necessary funds for work looking to the standardization of biological stains. In encouraging the domestic production of biological dyes, it is felt that an important service is being performed in that the market for these dyes is so limited as to make their commercial production unlikely. Their value to science, however, makes it highly desirable that this country have a source of supply independent of Germany.

With the National Research Council, the Foundation is collecting information as to chemical education. When the survey is complete, it is expected to have in hand full information as to the exact courses of instruction in chemical subjects at all American schools, together with details as to equipment, endowments and the num-

ber of students pursuing chemical courses.

The Foundation has an arrangement with the hygienic laboratory of the Public Health Service whereby all salvarsan and other arsenical compounds used for medicinal purposes are tested by the laboratory's chemists before being offered for sale. The Foundation is co-operating with the Fixed Nitrogen Laboratory in research work on the Haber patents, which are among those taken over by the Foundation. The Foundation also has been co-operating with R. C. Tolman, the director of the Fixed Nitrogen Laboratory, in the matter of encouraging Government inventors.

Arrangements recently were completed whereby the Chemical Foundation is to co-operate with the Bureau of Standards in the setting up of dye standards. The Foundation recently subscribed \$1,000 to assist in the preparation of a table of chemical constants, a work being conducted by the National Research Council.

If the Chemical Foundation is allowed to proceed with its program, it is expected to enlarge this type of co-operative work so as to extend help to most of the numerous chemical research laboratories being conducted under government or quasi-government auspices.

### Chicago Section, American Ceramic Society, Meets

Spring Meeting in Danville, Ill., Provides Interesting Papers and Inspection Trips

Although rather small in point of attendance, the first meeting of the Chicago section of the American Ceramic Society held outside of Chicago was most successful. About 15 members were present at the dinner at the Plaza Hotel, Danville, Ill., Friday evening, June 23.

Humidity driers were discussed by H. E. Davis of the Northwestern Terra Cotta Co. F. L. Steinhoff, chairman of the section and managing editor of *Brick and Clay Record*, outlined some recent developments in equipment and methods for manufacturing clay products. In an informal talk, E. J. Winkleman, chief engineer of the American Refractories Co., described the Baltimore plant of this company in which certain ideas used in the steel industry have been adapted to the manufacture of magnesite brick. Waste heat boilers utilize heat which is ordinarily lost up the stacks.

In order that the inspection trip through the plants of the Western Brick Co. might be as profitable as possible, Mr. Douthay, general superintendent in charge of production, called attention to some of the more important features of the company's operations—stripping by revolving shovel at one plant, the use of hydraulic stripping at another and the mechanical arrangement for pushing cars through the driers.



## Norris Blames Muscle Shoals Delay on Fertilizer Trust

**Ladd Bill Would Accept Ford Offer—Senator Says It Would Save Farmers \$3,000,000 a Year**

SENATOR NORRIS, of Nebraska, chairman of the Agricultural Committee of the Senate, who was overridden in his insistence that work in the Muscle Shoals dam should begin July 1, could not resist the temptation on that date to remind the Senate that, as a result of their action, a large number of men who might have been employed, were still without jobs. He addressed his remarks to the people of Alabama, calling attention to the Senate's amendment to the War Department appropriation bill which granted \$7,500,000 for the completion of Wilson dam but which included the provision that work should not be started until Oct. 1.

"I hope they will remember," he said, "that those who were giving close attention in the Senate to the Muscle Shoals proposition, and that the Senate, when it passed the appropriation of \$7,500,000, would have started that great work to-day, but that because of the great propaganda which influenced the honest and conscientious representatives from the great state of Alabama, and some from the great state of Michigan, where an interested millionaire lives, those men are not working to-day. The Tennessee River is low. The water of the stream is down so that they could do very effective and economical work.

"The effect of the great propaganda that even carried the Senate off its feet was to postpone that great work for a year, and I want the farmers of Alabama, bowed down to the earth with the burdens of the fertilizer trust, to know that through the efforts of their representatives in Congress that great fertilizer trust has been given another year of life to continue to hammer them down to the earth with toil and labor.

### MILLIONAIRE SENATORS HELPED DELAY

"I do not question the motive of any man, either in this body or in the other, because they were carried off their feet, they lost their judgment; but I wish the people of Alabama, the people of Mississippi, the people of Georgia, and of all the South and all the East would look over the roll call when we came to vote on it and see what that roll call means.

I have it in my hand, Mr. President, and while I am not an expert on the financial standing of the various members of this body, as nearly as I am able to determine, I find that the action of the House was confirmed here by a combination of men who were afraid it might be lost if we did not confirm it and by men who did not want anything done, and while it was being done ostensibly from the beginning in the interest of a great

millionaire, when it came to the Senate those who were frightened for fear they might lose it were assisted by every millionaire in the Senate, who voted at all, to give this great fertilizer trust another year of life."

In concluding the Senator pointed out the added tax burden imposed on the public by the year's delay in the construction work.

### LAST CHANCE FOR REVISED OFFERS

A final opportunity to offer further modifications to their proposals will be given to all bidders whose offers have been considered by the Senate Agricultural Committee according to Senator Norris' statement after an executive meeting of the committee on Thursday. Letters will be sent to the bidders inviting them to appear at a meeting at his home on July 13.

This course was suggested by several committeemen as a means of finding out whether the bidders have in any way agreed upon modifications.

### LADD FAVORS FORD OFFER

Unconditional acceptance of Henry Ford's offer for the purchase and lease of the Muscle Shoals projects, including the Government's interests in the steam power plants at Gorgas, is provided for in a bill introduced by Senator Ladd of North Dakota. The bill is identical with that introduced in the House by Representative Wright. The bill has the approval of several members of the Senate Agricultural Committee, of which its sponsor is a member.

In introducing the bill Senator Ladd called attention to the expenditures made by American farmers for nitrate importations from Chile and asked if "the farmers should continue to pay more than \$3,000,000 annually, when Mr. Ford offers to relieve them of these burdens at Muscle Shoals."

"The average importations of Chilean nitrate for five years, 1911-1915, inclusive," Senator Ladd said, "amounted to 551,714 long tons, with an average value at the Chilean port of \$17,511,697, and with an export duty paid to Chile on this tonnage amounting to \$6,910,978.92. The cost of ocean freight, insurance, commissions, etc., on this 5-year period of Chilean nitrate importations can be conservatively estimated at \$10 a ton, making a total cost at port of approximately \$29,939,815.92." Of this tonnage there was consumed as fertilizer by the farmers about 250,000 tons.

"Mr. Ford, in his final offer of May 30, expressly agrees and binds himself throughout the lease period to manufacture nitrogen and other commercial fertilizers, mixed or unmixed, and with or without filler, according to demands, and to produce fixed nitrogen at Muscle

Shoals equal to the fixed nitrogen contained in that portion of Chilean nitrate used by the farmers in the 5-year period, 1911-1915."

## Marconi Honored by Engineering Societies

**Receives John Fritz Medal in Presence of Distinguished Gathering in New York**

Senator Guglielmo Marconi received the John Fritz medal on July 6 before a gathering of engineers which filled the auditorium of the Engineering Societies Building in New York. Among the forty distinguished engineers on the platform were Major-General George W. Goethals, Orville Wright, Elihu Thomson and J. Waldo Smith, all of whom have received the same medal.

Senator Marconi received a great ovation as he rose to receive the medal and an even greater acclaim when he concluded his remarks in appreciation of the honor conferred upon him.

"I have long realized that in America, more than anywhere else, the most cordial and generous encouragement is given to an honest endeavor to apply science to useful and practical purposes," said Senator Marconi. "I consider myself fortunate that much of my early work in radio has been carried out in this country, for you realize that wireless communication has become useful, and often necessary, on land and sea, besides tending to increase and simplify the facilities for closer communications between distant people on this earth, thus contributing, I hope, to make good-will take the place of the unrest and mutual suspicion which, unfortunately, seems at present to be a dominating feeling amongst all nations."

Prof. Michael I. Pupin spoke on the progress and prospects for future developments in wireless communication. Prof. C. A. Adams, of Harvard, chairman of the medal committee of the four founder societies, paid a tribute to Marconi's work. James R. Sheffield, for many years Marconi's legal adviser in America, reviewed the life and work of the inventor.

## Bureau of Mines Announces Investigation Program

For the fiscal year which began July 1, the Bureau of Mines has at its disposition appropriations totaling \$1,580,900. The allotments of that sum for work which includes chemical activities are as follows: Technical work at Pittsburgh experiment station in connection with mine explosions, \$53,154; tests of explosives, \$50,737; tests of coal mine gases and dusts, \$31,655; technical service at Pittsburgh in connection with mineral fuel investigations, \$20,210; tests of mineral fuels, \$40,890; investigations concerning the preparation and treatment of ores, \$32,370; oil shale investigations, \$8,920; mining experiments stations, \$170,000; study of the chemical technology of oil, \$24,040.

### Planning for 1923 Meeting of American Chemical Society

Although present interest in American Chemical Society circles centers around the prospects for the September meeting in Pittsburgh it is interesting to note that plans are already forming for the following meeting which will take place in New Haven in April, 1923. The New Haven Section has invited the Connecticut Valley Section to join with them in entertaining the Society.

An executive committee, whose function it is to direct all plans and arrangements, has been chosen by the New Haven Section as follows: Treat B. Johnson, chairman; Blair Saxton, secretary; Arthur J. Hill, C. H. Mathewson, Ralph Langley, J. S. Graveley. Representatives both from outside New Haven in the local section and of the Connecticut Valley Section will be added later.

The meeting of the Society in New Haven will be of special interest, since in connection with this event the new Sterling Chemical Laboratory is to be dedicated by Yale University.

### Recent Developments Interest Paper Industry

The Westminster Paper Mill Co., Ltd., has been organized with a capital of \$250,000 by Wisconsin capitalists, for the purpose of establishing a mill for the manufacture of tissue paper at New Westminster, B. C. This will be the only paper mill of its kind on the Pacific Coast.

A quantity of pulp wood, about 700,000 ft., is now floating down the Kennebec river for the Pine Tree Pulp Co., a concern established only a few months ago. Ground was broken during the winter for the mill which is located at Gardiner.

The Cushnoe Paper Co. and Kennebec Paper Co., being operated by W. S. Wyman as receiver, are reported as showing a small margin of profit. With a return of normal business conditions, it is expected by Maine paper men that these companies will continue as a factor in Maine's paper production.

There is considerable interest in railroad activities in northeastern Maine. The Great Northern Paper Co. is continuing the building of a logging railroad of standard gauge. Hope is entertained that this eighteen mile road will be completed this season. The Eastern Maine Railroad Co., with charter rights in hand, are considering the question of a railroad from Houlton, in Aroostock County, down the east bank of the Penobscot River to tide water at Bangor where connection will be also made with the Grand Central Railroad. About twenty miles south of Houlton, it is proposed to build a short connecting line to the international boundary near Meductic to connect with the Canadian Pacific Railroad. The proposed road would be about 128 miles in length.

### Scientific Photography Now Included in Curriculum

#### Stockholm University Establishes Complete Laboratory for Technical Photographic Study

Scientific photography is the very latest science added to the subjects studied at the University of Stockholm. Quite recently, Docent Arvid Odenrants, Sweden's leading expert in this line, completed a fully equipped laboratory for scientific photography where the work is now carried on with great intensity and is attracting increasing interest on the part of scientific men and industrial experts in all parts of Sweden.

One of the most important practical aims of the new department is to test and classify the almost innumerable varieties of photographic films, many of them of foreign make, now in the market and to select the best kinds for recommendation to photographers. Films will be graded or classified according to their sensitiveness to light.

The laboratory will also devote itself to the study of photographic apparatus and lighting devices for moving picture purposes. It is closely co-operating with the X-Ray Institute of Stockholm. Important work is also being done in photomicrography, especially in connection with zoology and botany.

### Pittsburgh A.C.S. Meeting

#### Midgley Will Describe Work of General Motors Corporation on Gaseous Detonation

Of outstanding importance in the program of the Pittsburgh meeting of the American Chemical Society will be an address by Thomas Midgley, Jr., of the General Motors Research Corporation on "Chemical Control of Gaseous Detonation with Particular Reference to the Internal Combustion Engine." Mr. Midgley will be assisted by T. A. Boyd. The lecture will include demonstrations of normal combustion and detonation in glass tubes, the suppression of detonation by the addition of certain chemical compounds and demonstrations with an internal combustion engine motor containing quartz windows and apparatus for measuring radiation. The motor will be operated on detonating and non-detonating fuels. Lantern slides will be shown illustrating the periodic variation of anti-knock value among the 16 elements.

"Pittsburgh as a Chemical Manufacturing Center" is the subject of an address to be given by J. H. James, head of the Department of Chemical Engineering, and W. F. Rittman, head of the Department of Commercial Engineering, of Carnegie Institute of Technology. Dr. James will discuss "Pittsburgh's Raw Materials and Markets for Chemical Products." Dr. Rittman will speak on "Pittsburgh's Transportation and Financial Advantages."

By special arrangements, the Committee of the Pittsburgh section of the

A.C.S. has obtained dormitory privileges for the councillors at Carnegie Tech. during the Meeting. The Men's Dormitories will be opened to house 350. One of the Women's Dormitories has been offered for the use of the councillor's wives.

### Personal

H. B. BRAMLET, First Lieutenant, Chemical Warfare Service, was married on June 24 to Miss M. M. DuBois. They will be at home after July 15 at Edgewood Arsenal, Md.

C. B. DURGIN has been granted a leave of absence for 6 months from the Bureau of Soils, Washington, to aid in the development work of the Federal Phosphorus Co., Anniston, Ala. Mr. Durgin will be working particularly on the problems of manufacture of high purity phosphoric acid, assisting in the application of the methods for making this material which were developed recently at the Bureau of Soils under the general direction of Dr. W. H. Ross.

WALTER R. HIBBARD has withdrawn from the firm of Burt & Hibbard, Inc., consulting chemists, Bridgeport, Conn., to accept a position in charge of the physical and chemical laboratories of the Winchester Repeating Arms Co., New Haven, Conn.

Prof. H. F. MOORE, of the University of Illinois, addressed the Washington Chapter of the American Society for Steel Treating on June 30, 1922. His topic was "The Fatigue of Metals."

CULLEN W. PARMELEE, professor of ceramic engineering, University of Illinois, has been appointed acting head of the department of ceramic engineering, effective Sept. 1, succeeding E. W. Washburn.

The American Engineering Standards Committee announces the following additions and changes in personnel: F. J. SCHLINK, formerly of the development branch of the engineering department of the Western Electric Co., New York City, has been appointed assistant secretary of the committee. The Electrical Manufacturers Council has appointed A. I. DOREMUS, Crocker-Wheeler Co., New York City, as alternate for A. H. Moore, on the main committee of the American Engineering Standards Committee. The Gas Group has appointed W. J. SERRILL, United Gas Improvement Co., Philadelphia, Pa., as alternate for A. H. Hall on the main committee of the A.E.S.C. The U. S. Navy Department has designated Commander HARVEY DELANO, Bureau of Ordnance, Washington, D. C., and Vice-Commander H. F. LEARY to represent the Navy Department on the main committee of the A.E.S.C. The U. S. War Department has appointed Major GLEN F. JENKS, Ordnance Department, U. S. A., Washington, D. C., as alternate to Brigadier-General W. S. PIERCE, Ordnance Department, U. S. A., Washington, D. C., on the main committee of the A.E.S.C.



## Market Conditions

### IN CHEMICAL, METALLURGICAL AND ALLIED INDUSTRIES

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities—Prevailing Prices and Market Letters From Principal Industrial Centers

## Coal-Tar Products and Vegetable-Oil Markets During the Second Quarter of 1922

### The Trend of Market Developments and Important Price Changes in These Branches of the Chemical Industry

LAST WEEK'S ISSUE contained a review of market conditions for the principal industrial chemicals during the three months ended July 1, 1922. The only significant developments of that period were the general improvements noted in the prices for the more basic commodities and the wide fluctuations in the case of the lesser important and speculative articles. This generalization applies equally well to the coal-tar products market during the second quarter of 1922. Certain of the crudes, such as benzene and phenol showed exceptional strength and favorably affected the market for other crude products. On the other hand, the continued inactivity in the textile centers was reflected by the dormant condition of the intermediate and dye markets. Many of the producers most affected by the slackened demand

for staple products have found it profitable to turn their attention to specialties, such as rubber accelerators, photographic chemicals, etc.

#### MARKET DEVELOPMENTS

Outstanding among the features of this market has been the fact that in the face of unusually large production, benzene prices have been well maintained at comparatively high levels. Most of the producers' business has been in the regular contract requirements of consumers. A few odd lots have appeared in the resale market from time to time and these have brought as high as 40c. per gal. for the 90 per cent test. Quotations were advanced by producers during the interval from 27 to 28c. per gal. for the 90 per cent, and from 29 to 30c. per gal. for the water-white grade.

Phenol is another product to advance under an increasing demand. Material in the hands of dealers early in the year was gradually absorbed and the receipt of orders from foreign sources for large tonnages caused prices to advance from 12½c. per lb. in April to 15c. for June. Solvent naphtha, cresylic acid, toluene, cresol and salicylic acid have all shown improvement.

A number of declines were noted among the intermediates. Commodities which showed the effect of the unsatisfactory market for dyestuffs include aniline oil and salt, beta naphthol, diethyl aniline and dinitrobenzene.

#### THE VEGETABLE OIL MARKET

Practically all of the vegetable oils are in a stronger position than at the beginning of the current year. Part of this has been brought about by the tendency on the part of the industry to discourage hand-to-mouth buying in favor of contracts for deliveries over a period of three to six months.

An important commodity to show the effects of this regular trading was linseed oil. During the early part of 1922 the market was as low as 74c. per gal. Since February, 1922, prices were on a steady advance with the top mark of 90c. per gal. reached during the latter part of May. The summer months have had a tendency to weaken quotations and prices have since receded to 80c. per gal. During the past two weeks the market has shown a marked revival, with recent prices heard around 87c. per gal. for the domestic raw material in carload lots. Cottonseed oil was another item to show a sharp advance since Jan. 1, 1922. The opening quotation was around 7c. per lb. for the crude material, with a steady advance during February and March. Prices have been firmly maintained during the past few months around 9½@10c. per lb. Corn oil, peanut oil and soya bean oil have also shown considerable activity during the past few months.

PRICES OF 35 IMPORTANT COAL-TAR PRODUCTS BY MONTHS, JANUARY-JULY, 1922

Article	Unit	Jan.	Feb.	March	April	May	June	Price on July 1
Benzene, c.p.	Gal.	\$0.29	\$0.29	\$0.29	\$0.29	\$0.29	\$0.30	\$0.30
Cresylic acid, 95-97%	Gal.	.60	.45	.45	.48	.48	.50	.51
Dip oil, 25%	Gal.	.31	.27	.24	.24	.24	.24	.24
Solvent naphtha, water, white	Gal.	.25	.25	.25	.25	.25	.27	.27
Toluene, water white	Gal.	.30	.30	.30	.30	.30	.30	.30
Xylene, pure	Gal.	.40	.40	.40	.40	.40	.40	.40
H acid	Lb.	.97	.90	.85	.85	.85	.85	.85
Phthalic anhydride	Lb.	.37	.37	.35	.36	.35	.35	.35
Salicylic acid, tech.	Lb.	.20	.18	.23	.23	.25	.25	.25
Alpha naphthylamine	Lb.	.28	.28	.30	.30	.30	.30	.30
Aniline oil	Lb.	.17	.17	.16	.16	.15	.14	.14
Aniline salt	Lb.	.25	.24	.24	.24	.22	.22	.22
Anthracene, 80%	Lb.	.75	.75	.75	.75	.75	.75	.75
Benzaldehyde, U.S.P.	Lb.	1.35	1.30	1.25	1.25	1.25	1.25	1.25
Benzonate of soda, U.S.P.	Lb.	.52	.55	.55	.55	.50	.50	.50
Benzidine, base	Lb.	.85	.85	.85	.85	.85	.85	.85
Benzidine, sulphate	Lb.	.75	.75	.75	.75	.75	.80	.80
Beta naphthol, tech.	Lb.	.31	.29	.28	.27	.25	.23	.23
Dichlorobenzene	Lb.	.06	.06	.06	.06	.06	.06	.06
Dinitrobenzene	Lb.	.21	.21	.23	.23	.22	.22	.20
Diethylaniline	Lb.	.90	.95	1.15	.85	.65	.65	.65
Dimethylaniline	Lb.	.40	.41	.38	.38	.37	.36	.36
Dinitrophenol	Lb.	.38	.35	.33	.33	.33	.33	.33
Diphenylamine	Lb.	.60	.60	.59	.59	.59	.59	.59
Naphthalene, flake	Lb.	.07	.06	.06	.06	.06	.06	.06
Naphthalene, ball	Lb.	.08	.07	.08	.08	.08	.08	.07
Nitrobenzene	Lb.	.10	.10	.10	.10	.10	.10	.10
Ortho-nitro-toluene	Lb.	.15	.15	.12	.12	.12	.10	.10
Para-phenylenediamine	Lb.	1.60	1.55	1.50	1.50	1.55	1.55	1.55
Para-amidophenol, base	Lb.	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Para-amidophenol, HCl	Lb.	1.45	1.35	1.30	1.30	1.30	1.30	1.30
Para-dichlorobenzene	Lb.	.16	.17	.15	.15	.13	.17	.17
Paranitraniline	Lb.	.77	.77	.75	.75	.75	.73	.73
Phenol, U.S.P.	Lb.	.11	.12	.11	.12	.14	.14	.14
Resorcinol, tech.	Lb.	1.45	1.30	1.30	1.30	1.30	1.30	1.30
Toluidine, mixed	Lb.	.32	.32	.32	.30	.30	.30	.30

PRICES OF PRINCIPAL VEGETABLE OILS BY MONTHS, JANUARY-JULY, 1922

	Unit	Jan.	Feb.	March	April	May	June	July
Castor oil, AA, in bbl.	Lb.	\$0.11	\$0.11	\$0.11	\$0.11	\$0.12	\$0.12	\$0.12
China wood oil, in bbl.	Lb.	.13	.14	.14	.13	.13	.13	.13
Coconut oil, Ceylon grade in bbl.	Lb.	.09	.08	.09	.08	.08	.08	.08
Corn oil, crude, in bbl.	Lb.	.08	.08	.11	.11	.11	.11	.11
Cottonseed oil, crude tank cars, f.o.b. mill.	Lb.	.07	.08	.10	.09	.10	.10	.10
Cottonseed oil, summer yellow	Lb.	.09	.09	.11	.12	.12	.11	.11
Linseed oil, raw, in bbl., domestic	Gal.	.70	.83	.81	.84	.87	.82	.87
Palm oil, lagoon	Lb.	.08	.08	.08	.07	.07	.07	.07
Peanut oil, crude, tank cars, f.o.b. mill.	Lb.	.07	.08	.10	.09	.10	.10	.09
Rapeseed oil, refined, in bbl.	Lb.	.82	.84	.85	.84	.83	.84	.84
Soya bean oil, in bbl., N. Y.	Lb.	.08	.09	.10	.10	.11	.12	.12

### "Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	156.67
Last week	157.52
July, 1921	148
July, 1920	274
April, 1918 (high)	286
April, 1921 (low)	140

Six of the twenty-five commodities on which this index is based changed in price during the week. Three—ammonium sulphate, glycerine and linseed oil—were higher, while caustic potash, caustic soda and cottonseed oil contributed to the decline, which amounted to 0.85.

## Wages and Hours of Labor in the Petroleum Industry

Some interesting industrial statistics have recently been brought to light in a study made by the U. S. Bureau of Labor Statistics of wages, hours and earnings in the petroleum industry during 1920. Reports were received from the payrolls of plants estimated to represent 25 per cent of the total number of employees engaged in the drilling and operation of oil wells, 50 per cent of all pipe-line employees and 35 per cent of all oil-refinery employees.

The regular working schedule of 74 per cent of all employees at the oil wells was seven days per week, the remaining 26 per cent being six-day workers. On the pipe lines 34 per cent worked 7 days and 66 per cent 6 days. At the refineries, however, but 23 per cent of the employees were 7-day workers and 77 per cent 6-day workers.

The customary hours of work at the wells and on the pipe lines ranged from 8 to 12 per day and at the refineries from 8 to 13. Forty-five per cent of the employees at wells, 43 per cent on pipe lines, and 65 per cent at refineries worked not more than 8 hours per day; 76 per cent at wells, 77 per cent on pipe lines, and 96 per cent at refineries not more than 9 hours; while 85 per cent at wells and 99 per cent on pipe lines, and 99 per cent at refineries worked not more than 10 hours.

It is of interest to note that of 80 refineries located in 15 states and employing 42,537 males and 274 females, women were found in productive work in only 5 establishments, located in 5 states. They were engaged principally in filling and packing bottles, cartons, etc., and only a few were working at common labor.

A summary of the average full-time hours per week and the average earnings per hour are given in the following table. In connection with the wage rates, it should be emphasized that these are the wages in effect in November, 1920, and that in some of the larger establishments substantial reductions have been reported. In most

Occupation	Average Hours Per Week	Average Earnings Per Hour
<b>Wells:</b>		
Drillers	73.6	\$1.140
Drillers' helpers and cleanout helpers	59.7	.683
Firemen	57.7	.651
Laborers, roustabouts and connection men	57.7	.589
Pumpers and engineers	62.5	.582
Tool dressers	78.6	.934
<b>Pipe Lines:</b>		
Engineers and pumpers	57.2	.749
Firemen	55.7	.701
Gaugers, deliverymen and oil receivers	58.9	.775
Laborers, roustabouts, etc.	54.7	.528
Line walkers	62.5	.584
Telegraph operators	56.0	.676
<b>Refineries:</b>		
Engineers and chilermen	55.3	.811
Firemen and assistant engineers	53.6	.756
Pumpmen	53.6	.789
Stillmen	54.2	.905
Stillmen's assistants, chargers and headers-up	53.6	.799
Boilermakers	48.1	.991
Boilermakers' helpers	47.6	.741
Laborers	49.7	.575
Machinists	48.5	.905
Pipe fitters	49.4	.855
Pipe fitters' helpers	48.8	.685

cases reductions meant that a part or the whole of certain war-time bonuses were discontinued.

In addition to the statistical sections of the report (Bulletin 297, dated April, 1922) some interesting information is given regarding duties and division of work in the three principal branches of the petroleum industry.

## The New York Market

NEW YORK, July 10, 1922.

The chemical market during the past week has shown the effects of the recent holiday period and trading, in general, has been of a desultory character. About 90 per cent of the trade closed from Saturday until Wednesday morning and business was limited to only a few days of full trading. With the exception of a few commodities, there were no features of outstanding interest. Arsenic, tartaric acid, calcium acetate, copper sulphate and ammonium sulphate showed considerable activity, with quotations in some instances fractionally higher. Prussiates, caustic potash, caustic soda and soda ash have revealed no appreciable changes during the interval and quotations were subject to slight shading on firm business.

### GENERAL AND SPECIAL CHEMICALS

**Arsenic**—Domestic producers are quoting higher prices for nearby goods. Importers have also fallen in line with the advancing tendency and only a few odd lots are heard of at 7½c. per lb. The regular range for prime materials is around 7½@8c. per lb.

**Barium Chloride**—Leading factors and importers quote spot material at \$95@\$100 per ton. Goods afloat are held at \$92 per ton with shipments at \$86.

**Bleaching Powder**—Prices in general remain unaltered at \$1.60 per 100 lb. f.o.b. works for large drums. Imported material is scarce on the spot market and quoted at \$1.70 ex store.

**Caustic Potash**—Imported 88-92 per cent goods have been offered down to \$5.50 per 100 lb. for spot delivery. Recent heavy arrivals are responsible for the competition among sellers and lack of interest from consuming quarters. The general range is around 5½@6c. per lb.

**Caustic Soda**—The export market has shown no activity whatsoever during the past week. Leading producers offer standard brands at \$3.70@\$3.75 per 100 lb., f.a.s. The movement in domestic circles has been quite satisfactory to dealers and reports show a notable improvement during the month of June. Goods ex-store are held at \$3.75 per 100 lbs.

**Copper Sulphate**—Spot material is practically extinct. The demand is far greater than the available supply and July allotments seem to be well sold up. Quotations range around 6½@6¾c. per lb.

**Glycerine**—There was a firmer feeling noted in this market due to the lighter offerings from first-hand

sources. Chemically pure was a fraction higher at 15c. per lb. Dynamite glycerine was held around 13½c. per lb.

**Nitrite of Soda**—Trading was along limited lines with imported material quoted around 8½c. per lb. Domestic producers were holding 9c. per lb. as the regular carlot quotation.

**Permanganate of Potash**—Imported U. S. P. Crystals were offered at 14½c. per lb. The demand showed little signs of any future activity.

**Prussiate of Potash**—Prices for yellow material were lower than the last report. Business has not been very encouraging during the interval and sellers offered spot goods at 32c. per lb. The red material still maintains the high figure around 90c. per lb.

**Prussiate of Soda**—The demand for this material has been rather weak during the past few days and sellers were offering spot goods at 21½c. per lb. Shipments were quoted at 20c. per lb.

**Soda Ash**—Prices have shown no appreciable change and prominent dealers were offering carload lots of single bags at \$1.75@\$1.80 per lb. on spot, with barrels at \$1.95@\$2 per 100 lb. Contracts remain unchanged.

**Sulphate of Ammonia**—There has been a pronounced shortage of this material and the market is in a very strong position. Prices for double bags f.a.s. have advanced to \$3.45@\$3.50 per 100 lb.

### COAL-TAR PRODUCTS

There have been no signs of any special interest in the crude and intermediate markets during the past week. Large producers of crudes reported a steady call from the various consuming industries with no particular advance or decline along the list. The intermediate market remained in a very dormant state due to the absence of real interest from domestic buyers. Textile mills, it will be recalled, have been operating on an extremely conservative basis of late.

**Benzene**—Consumers have shown no desire to ease up on the demand for supplies and the producers report an extremely strong market for future business. The pure material is quoted at 30@35c. per gal. with 90 per cent at 28@31c. per gal. Spot lots are held by second hands at 40c. and higher for the 90 per cent grade.

**Beta Naphthol**—Sales of technical material were recorded at 23c. per lb. Producers are somewhat higher and quote the market at 24c. Competition remains keen for any passing business, with prices subject to shading.

**Cresylic Acid**—A continued active inquiry has kept the market in a very firm position. Supplies of domestic and foreign goods are rather light on spot, with the 97-99 per cent domestic held at 56@58c. per gal. and 95-97 per cent at 51@53c. Imported high test goods sold up to 65c. per gal.

**Paranitraniline**—Inquiries have recently been received in satisfactory volume and sales are reported at 75c. per lb. The general range is from 75@80c. per lb.



## The St. Louis Market

ST. LOUIS, July 6, 1922.

During the past two weeks activities in the industrial chemical market have been somewhat quiet, but this is only to be expected at this time of the year. We do not believe, however, that this lull will prevail for as long a period as in previous years, as stocks on many items are still being carried on a minimum basis and replacements must be made more frequently. The tone of the market remains quite steady, with a few advances since our last report. Imported chemicals are inactive.

### ALKALIS

The caustic soda market has been rather quiet since our last report. Small quantity purchases are about nominal with nothing of a carload nature to report. Prices have not fluctuated, flake caustic in single drum lots holding around \$4.50 per 100 lb., while solid can be bought at \$4. Soda ash has done nothing unusual for some time. There has been no tendency toward price fluctuation or an increased or decreased demand. Bicarbonate of soda is at present the wild member of the alkali group in so far as it is impossible to say at any time at what price it can or cannot be bought. Replacement goods, however, are somewhat stronger and should have a tendency to stabilize the market. Sal soda has recently stiffened a bit and no price cutting has been felt recently. A good volume of business is being done in this item. Prices for barrels are \$1.75 per 100 lb., while package goods sell at \$2.15 per case.

### GENERAL AND SPECIAL CHEMICALS

Producers of heavy mineral acids report a continued improvement in this line, with prices much stronger. Carbolic acid, medicinal grade, is moving very well and prices are firm. Citric acid manages to keep pace with last year, with spot stocks of domestic material still very scarce. Further advances have been made in oxalic acid due to the increased cost of basic material. Last week prices ranged from 14½@16c., the demand being very good with a fairly large expansion over a month ago. Tartaric acid is coming to life and some very substantial orders have been placed during the past two weeks, prices remaining at the former levels. White arsenic, powdered, is very strong and is now being quoted at 7½c. f.o.b. New York with a short supply and large demand. Carbon bisulphide, being a seasonable article, is showing up very well and in all probability will continue to do so, as we are now arriving at a season when it will be used quite extensively in the agricultural districts of the country in destroying boll weevil and other insects infesting crops. Carbon tetrachloride, technical, is moving in a routine way. Some time ago the demand for copperas was far in excess of supplies; however, today supplies have been increased and spot stocks are available

at \$18@20 per ton in carload lots f.o.b. producers' works. There has been considerable action in the glycerine market since our last report. This being a time of contract making, some changes are naturally expected. One producer was offering contracts for six months, with protection against decline, at 14c., basis drums, others as low as 14½c. on contracts for a few days only—spot goods at 14½c.—and then suddenly back to 15c. for both contract and spot. At present the price of 15c. seems firm and will undoubtedly be rock bottom for six months to come. There has been no change in the potash cyanide situation, stocks still being limited and the demand routine. Zinc sulphate, technical, is in very good demand and there are persistent rumors of an advance.

### VEGETABLE OILS AND NAVAL STORES

Turpentine has covered a large range of prices recently, the peak being \$1.54 per gal. in single barrels, but it has gone downward again and can now be had at \$1.30. Linseed oil is moving in good volume now, owing to increased activity in the paint industry. Prices have not changed noticeably. Castor oil is still being held at 12½c., with a normal volume of business being transacted.

## The Iron and Steel Market

PITTSBURGH, July 7, 1922.

While the actual tonnage of output of pig iron and steel may not be increasing at the moment, on account of weather conditions usual in July and August, the capacity of production units in operation still tends to increase. The number of furnaces in blast increases from week to week. For instance, last week the Republic Iron & Steel Co. blew in a third stack at Youngstown while on July 5 it put in operation its bessemer department, idle since last September.

### STEEL INGOT PRODUCTION

Production of steel ingots averaged in May a rate of about 38,250,000 gross tons per annum, and the rate in the past fortnight, counting out time lost by the holiday, which was observed at most plants Monday as well as Tuesday, was probably about 40,000,000 tons, which compares with a rate of about 35,000,000 tons on April 1, when the coal strike started, and a rate of about 20,000,000 tons last December.

Inasmuch as it is unprofitable to blow in a blast furnace for a short period, the continued addition of stacks to the active list is proof that the iron and steel trade feels confidence as to the future not only of its coke supplies but also of its fuel supplies, as it is useless to make pig iron unless there is fuel for power and heating steel. If an actual shortage of coal is looked for, therefore, it appears that it should be sought elsewhere than in the iron and steel industry. There is no circumstantial evidence, furthermore, that any shortage has developed among con-

sumers of steel, as buyers are still pressing steel mills for deliveries.

As to tonnage turnover, the finished steel market is now decidedly quiet, as it almost invariably is in July and August. The dullness gradually stole over the market during June. The steel industry, as to production and consumption, is wound up to run well for the next 2 or 3 months on the basis of engagements already made, and does not require that there be market activity at the present time. The question is solely as to the more distant future. To date there has been no menacing accumulation of steel in the hands of buyers. Production of steel ingots in 1921 was about 19,000,000 tons, while the drastic liquidation of stocks of steel in buyers' hands and of manufactured wares probably represented all of 3,000,000 tons, making 22,000,000 tons a fair guess as the representation of consumption. An increase of only 25 per cent in consumption in the past 6 months over the average of 1921 would require almost 14,000,000 tons of ingots, while production in the 6 months has been 16,000,000 tons. The difference of 2,000,000 tons might represent replenishment of badly depleted stocks and provision of stocks for the filling of actual orders at manufacturing plants consuming steel. The accumulation may be even less than here suggested.

### IRON AND STEEL PRICES

The market stands substantially as follows: Bars, shapes and plates, 1.60@1.70c.; hoops and bands, 2.40@2.50c.; standard steel pipe, 71 per cent basing discount; nails, \$2.40@\$2.50; blue annealed sheets, 2.40@2.50c.; black sheets, 3.15@3.30c.; galvanized sheets, 4.15@4.30c.; automobile sheets, 4.50@4.85c.; tin plate, \$4.75. Fabricated wire fence has been reduced about \$4 a net ton, the discount on jobbers' carloads being increased from 71½ per cent to 73 per cent. Demand has been relatively light for a long time.

While a few sales of sheet bars were reported recently at \$37.50@\$38, the common settling price now is \$35. The Carnegie adjustment price for third quarter, on regular contracts, is understood to be \$33, against \$31 for second quarter and \$30 for first quarter. Billets and slabs are quotable at \$35, by inference from sheet bars, there being no open market transactions of note.

Wire rods, which had been at the practically nominal price of \$38, have been advanced to \$40, and even at this price producers are indisposed to sell except to regular customers.

Pig iron continues quiet as to actual turnover. In several districts asking prices have advanced slightly in the past week or two. The valley market is unchanged, with prices practically nominal at \$25 for bessemer and basic and \$24 for foundry, f. o. b. valley furnaces. On the whole the valley market does not seem to be as firm as 30 days ago. Freight from valleys to Pittsburgh came down July 1 from \$1.96 to \$1.76.

## General Chemicals

## CURRENT WHOLESALE PRICES IN NEW YORK MARKET

	Carlots F.o.b. N.Y.	Less Carlots F.o.b. N.Y.
Acetic anhydride, 100 lbs.	8.50 - 9.00	5.50 - 5.50
Acetone, 100 lbs.	2.25 - 2.50	2.55 - 3.00
Acid, acetic, 28 per cent, 100 lbs.	5.00 - 5.25	5.30 - 5.50
Acetic, 56 per cent, 100 lbs.		
Acetic, glacial, 99 per cent, carboys, 100 lbs.	8.50 - 9.00	5.50 - 5.50
Boric, crystals, 100 lbs.	1.10 - 1.20	1.25 - 1.70
Boric, powder, 100 lbs.	1.10 - 1.11	1.11 - 1.12
Citric, 100 lbs.	1.10 - 1.20	1.25 - 1.70
Hydrochloric, 52 per cent, 100 lbs.	1.10 - 1.20	1.25 - 1.70
Lactic, 44 per cent tech., 100 lbs.	0.90 - 1.00	1.00 - 1.10
Lactic, 22 per cent tech., 100 lbs.	0.40 - 0.44	0.40 - 0.45
Molybdic, e.p., 100 lbs.	3.00 - 3.25	3.30 - 3.75
Muriatic, 20 deg. (see hydrochloric), 100 lbs.		
Nitric, 40 deg., 100 lbs.	0.60 - 0.64	0.60 - 0.67
Nitric, 42 deg., 100 lbs.	0.60 - 0.64	0.60 - 0.67
Oxalic, crystals, 100 lbs.	1.40 - 1.44	1.50 - 1.55
Phosphoric, 50 per cent solution, 100 lbs.	0.80 - 0.88	0.80 - 0.89
Picric, 100 lbs.	2.00 - 2.2	2.30 - 2.7
Pyrogallol, resublimed, 100 lbs.		1.65 - 1.75
Sulphuric, 60 deg., tank cars, 100 tons	9.50 - 10.00	
Sulphuric, 60 deg., drums, 100 tons	12.00 - 14.00	
Sulphuric, 66 deg., tank cars, 100 tons	15.00 - 16.00	
Sulphuric, 66 deg., drums, 100 tons	19.00 - 20.00	20.50 - 21.00
Sulphuric, 66 deg., carboys, 100 tons		
Sulphuric, fuming, 20 per cent (oleum), tank cars, 100 tons	19.00 - 20.00	
Sulphuric, fuming, 20 per cent (oleum), drums, 100 tons	22.00 - 22.50	23.00 - 24.00
Sulphuric, fuming, 20 per cent (oleum), carboys, 100 tons	31.00 - 32.00	33.00 - 34.00
Tannic, U. S. P., 100 lbs.	40 - 45	46 - 50
Tannic (tech.), 100 lbs.		29 - 29.4
Tartaric, imported crystals, 100 lbs.		29 - 30
Tartaric acid, imported, powdered, 100 lbs.		29 - 30
Tartaric acid, domestic, 100 lbs.		1.00 - 1.10
Tungstic, per lb. of WO <sub>3</sub> , 100 lbs.		4.75 - 4.95
Alcohol, ethyl (Cologne spirit), gal.		26 - 30
Alcohol, methyl (see methanol), gal.		26 - 30
Alcohol, denatured, 188 proof No. 1, gal.		0.32 - 0.34
Alcohol, denatured, 188 proof No. 5, gal.		0.32 - 0.34
Alum, ammonia, lump, 100 lbs.	0.34 - 0.34	0.32 - 0.34
Alum, potash, lump, 100 lbs.	0.3 - 0.34	0.32 - 0.34
Alum, chrome lump, 100 lbs.	0.51 - 0.51	0.6 - 0.64
Aluminum sulphate, commercial, 100 lbs.	1.50 - 1.65	1.70 - 2.25
Aluminum sulphate, iron free, 100 lbs.	0.21 - 0.21	0.3 - 0.31
Aqua ammonia, 26 deg. drums (750 lb.), 100 lbs.	0.6 - 0.7	0.7 - 0.8
Ammonia, anhydrous, cyl. (100-150 lb.), 100 lbs.	0.30 - 0.30	0.30 - 0.31
Ammonium carbonate, powder, 100 lbs.	0.7 - 0.7	0.7 - 0.8
Ammonium nitrate, 100 lbs.	0.6 - 0.6	0.6 - 0.7
Amylacetate tech., gal.		2.00 - 2.25
Arsenic, white, powdered, 100 lbs.	0.71 - 0.71	0.8 - 0.81
Arsenic, red, powdered, 100 lbs.	1.2 - 1.2	1.2 - 1.3
Barium carbonate, 100 lbs.	0.3 - 0.4	0.4 - 0.5
Barium chloride, 100 lbs.	95.00 - 100.00	105.00 - 110.00
Barium dioxide (peroxide), 100 lbs.	20 - 21	21 - 22
Barium nitrate, 100 lbs.	0.7 - 0.7	0.7 - 0.8
Barium sulphate (precip.) (blanc fixe), 100 lbs.	0.4 - 0.4	0.4 - 0.41
Blanc fixe, dry, 100 lbs.	0.4 - 0.4	
Blanc fixe, pulp, 100 lbs.	45.00 - 55.00	
Bleaching powder, 100 lbs.	1.60 - 1.75	1.85 - 2.50
Blue vitriol (see copper sulphate), 100 lbs.		0.6 - 0.61
Borax, 100 lbs.	0.51 - 0.51	0.6 - 0.61
Bromine, 100 lbs.	27 - 28	28 - 35
Bromine, 100 lbs.	2.00 - 2.25	
Calcium acetate, 100 lbs.	0.4 - 0.4	0.5 - 0.51
Calcium carbide, 100 lbs.	0.4 - 0.4	0.5 - 0.51
Calcium chloride, fused, lump, 100 lbs.	24.00 - 24.50	24.75 - 27.00
Calcium chloride, granulated, 100 lbs.	0.11 - 0.11	0.2 - 0.21
Calcium peroxide, 100 lbs.		1.40 - 1.50
Calcium phosphate, tribasic, 100 lbs.		15 - 16
Camphor, 100 lbs.		80 - 83
Carbon bisulphide, 100 lbs.	0.6 - 0.61	0.7 - 0.71
Carbon tetrachloride, drums, 100 lbs.	0.91 - 1.0	1.0 - 1.2
Carbonyl chloride, (phosgene), 100 lbs.		60 - 75
Caustic potash (see potassium hydroxide), 100 lbs.		
Caustic soda (see sodium hydroxide), 100 lbs.		
Chalk, precip.—domestic, light, 100 lbs.	0.41 - 0.41	
Chalk, precip.—domestic, heavy, 100 lbs.	0.31 - 0.31	
Chalk, precip.—imported, light, 100 lbs.	0.41 - 0.41	
Chlorine, gas, liquid-cylinders (100 lb.), 100 lbs.	0.5 - 0.51	0.51 - 0.6
Chloroform, 100 lbs.		25 - 32
Cobalt oxide, 100 lbs.		2.00 - 2.10
Copperas, 100 lbs.	20.00 - 22.00	23.00 - 30.00
Copper carbonate, green precipitate, 100 lbs.	19 - 20	20 - 21
Copper cyanide, 100 lbs.		58 - 60
Copper sulphate, crystals, 100 lbs.	6.50 - 6.60	6.65 - 7.00
Cream of tartar, 100 lbs.		24 - 25
Epsom salt (see magnesium sulphate), 100 lbs.		60 - 65
Ethyl acetate con. 85%, gal.		90 - 95
Ethyl acetate, pure (acetic ether, 98% to 100%), gal.		0.8 - 0.9
Formaldehyde, 40 per cent, gal.	0.81 - 0.81	0.81 - 0.9
Fullers earth, f.o.b. mines, net ton	16.00 - 17.00	
Fullers earth—imported powdered—net ton	30.00 - 32.00	
Fusel oil, ref., gal.		2.25 - 2.65
Fusel oil, crude, gal.		1.45 - 1.50
Glauber's salt (see sodium sulphate), 100 lbs.		15 - 15.1
Glycerine, e. p. drums extra, 100 lbs.		4.20 - 4.25
Iodine, resublimed, 100 lbs.		12 - 18
Iron oxide, red, 100 lbs.		0.9 - 1.1
Lead acetate, 100 lbs.		13 - 14
Lead arsenate, powd., 100 lbs.	13 - 13.1	13 - 14
Lead nitrate, 100 lbs.		15 - 20
Litharge, 100 lbs.	0.7 - 0.8	0.8 - 0.9
Magnesium carbonate, technical, 100 lbs.	2.00 - 2.25	2.30 - 2.50
Magnesium sulphate, U. S. P., 100 lbs.		1.00 - 1.80
Magnesium sulphate, technical, 100 lbs.		57 - 58
Methanol, 95%, gal.		59 - 60
Methanol, 97%, gal.		11 - 11.1
Nickel salt, double, 100 lbs.		10 - 10.1
Nickel salt, single, 100 lbs.		

	Carlots F.o.b. N.Y.	Less Carlots F.o.b. N.Y.
Phosgene (see carbonyl chloride), 100 lbs.		40 - 45
Phosphorus, red, 100 lbs.		30 - 35
Phosphorus, yellow, 100 lbs.		10 - 10.1
Potassium bichromate, 100 lbs.	0.91 - 1.0	1.7 - 2.3
Potassium bromide, granular, 100 lbs.		13 - 16
Potassium carbonate, U. S. P., 100 lbs.	1.2 - 1.21	0.51 - 0.6
Potassium carbonate, 80-85%, 100 lbs.	0.5 - 0.51	0.71 - 0.8
Potassium chlorate/powdered and crystals, 100 lbs.	0.61 - 0.7	50 - 52
Potassium cyanide, 100 lbs.	5.50 - 5.75	6.00 - 6.25
Potassium hydroxide (caustic p. ash), 100 lbs.		3.20 - 3.35
Potassium iodide, 100 lbs.	0.61 - 0.61	0.7 - 0.8
Potassium nitrate, 100 lbs.	1.4 - 1.41	1.5 - 1.6
Potassium permanganate, 100 lbs.		90 - 95
Potassium prussiate, red, 100 lbs.	32 - 32.1	32.1 - 33
Potassium prussiate, yellow, 100 lbs.		
Rochelle salts (see sodium potas. tartrate), 100 lbs.		
Salammoniac, white, granular, 100 lbs.	0.61 - 0.7	0.71 - 0.8
Salammoniac, gray, granular, 100 lbs.	0.71 - 0.8	0.81 - 0.81
Salsoda, 100 lbs.	1.20 - 1.40	1.45 - 1.60
Salt cake (bulk), 100 tons	20.00 - 25.00	
Soda ash, light, 58 per cent flat, bags, contract, 100 lbs.	1.65 - 1.70	2.00 - 2.25
Soda ash, light, 58 per cent flat, bags, resale, 100 lbs.	1.75 - 1.80	1.85 - 2.35
Soda ash, dense, in bags, resale, 100 lbs.	1.85 - 1.90	1.95 - 2.40
Sodium acetate, 100 lbs.	0.61 - 0.61	0.6 - 0.7
Sodium bicarbonate, 100 lbs.	1.75 - 1.85	1.90 - 2.30
Sodium bichromate, 100 lbs.	0.7 - 0.71	0.71 - 0.71
Sodium bisulphate (nitre cake), 100 lbs.	4.50 - 4.60	4.65 - 5.50
Sodium bisulphite powdered, U.S.P., 100 lbs.	0.41 - 0.41	0.41 - 0.51
Sodium chlorate, 100 lbs.	0.61 - 0.61	0.7 - 0.71
Sodium chloride, long ton	12.00 - 13.00	
Sodium cyanide, 100 lbs.	21 - 22	22.1 - 25
Sodium fluoride, 100 lbs.	0.91 - 1.0	1.01 - 1.01
Sodium hydroxide (caustic soda) solid, 76 per cent flat, drums, contract, 100 lbs.	3.35 - 3.50	3.80 - 4.00
Sodium hydroxide (caustic soda) solid, 76% flat, drums, resale, 100 lbs.	3.70 - 3.75	3.80 - 4.10
Sodium hydroxide (caustic soda), ground and flake, contracts, 100 lbs.	3.85 - 4.00	4.30 - 4.50
Sodium hydroxide (caustic soda) ground and flake, resale, 100 lbs.	4.00 - 4.15	4.40 - 4.70
Sodium hyposulphite, 100 lbs.	0.3 - 0.31	0.31 - 0.4
Sodium nitrite, 100 lbs.	0.81 - 0.81	0.9 - 0.91
Sodium peroxide, powdered, 100 lbs.	28 - 30	31 - 35
Sodium phosphate, dibasic, 100 lbs.	0.31 - 0.4	0.41 - 0.41
Sodium potassium tartrate (Rochelle salts), 100 lbs.		18 - 21
Sodium prussiate, yellow, 100 lbs.	21 - 21.1	21.1 - 22
Sodium silicate, (40 deg. in drums), 100 lbs.	80 - 1.00	1.05 - 1.25
Sodium silicate, (60 deg. in drums), 100 lbs.	2.25 - 2.40	2.45 - 2.75
Sodium sulphate, crystals (Glauber's salt), 100 lbs.	90 - 1.00	1.05 - 1.50
Sodium sulphide, fused, 60-62 per cent (conc.), 100 lbs.	0.41 - 0.41	0.41 - 0.5
Sodium sulphite, crystals, 100 lbs.	0.31 - 0.31	0.31 - 0.41
Strontium nitrate, powdered, 100 lbs.	0.9 - 1.0	1.01 - 1.2
Sulphur chloride, yellow, 100 lbs.	0.41 - 0.5	0.51 - 0.6
Sulphur, crude, 100 tons	18.00 - 20.00	
Sulphur dioxide, liquid, cylinders extra, 100 lbs.	0.8 - 0.81	0.9 - 1.0
Sulphur (sublimed), flour, 100 lbs.		2.25 - 3.10
Sulphur, roll (brimstone), 100 lbs.	2.00 - 2.15	2.20 - 2.70
Tale—imported, 100 tons	30.00 - 40.00	
Tale—domestic powdered, 100 tons	18.00 - 25.00	
Tin bichloride, 100 lbs.	0.9 - 0.91	0.91 - 1.0
Tin oxide, 100 lbs.		35 - 37
Zinc carbonate, 100 lbs.	14 - 14.1	14.1 - 15.1
Zinc chloride, gran., 100 lbs.	0.6 - 0.61	0.61 - 0.7
Zinc cyanide, 100 lbs.	42 - 44	45 - 47
Zinc oxide, XX, 100 lbs.	0.71 - 0.8	0.81 - 0.81
Zinc sulphate, 100 lbs.	2.75 - 3.00	3.05 - 3.30

## Coal-Tar Products

NOTE—These prices are for original packages in large quantities f.o.b. N.Y.:

Alpha-naphthol, crude, 100 lbs.	\$1.00 - \$1.05
Alpha-naphthol, refined, 100 lbs.	1.10 - 1.15
Alpha-naphthylamine, 100 lbs.	30 - 31
Aniline oil, drums extra, 100 lbs.	14 - 16
Aniline salts, 100 lbs.	22 - 24
Anthracene, 80% in drums (100 lb.), 100 lbs.	75 - 1.00
Benzaldehyde U.S.P., 100 lbs.	1.25 - 1.30
Benzene, pure, water-white, in drums (100 gal.), gal.	30 - 35
Benzene, 90% in drums (100 gal.), gal.	28 - 32
Benzidine, base, 100 lbs.	85 - 95
Benzidine sulphate, 100 lbs.	85 - 85
Benzoic acid, U.S.P., 100 lbs.	60 - 65
Benzonate of soda, U.S.P., 100 lbs.	50 - 55
Benzyl chloride, 95-97%, refined, 100 lbs.	25 - 27
Benzyl chloride, tech., 100 lbs.	20 - 23
Beta-naphthol benzoate, 100 lbs.	3.75 - 4.00
Beta-naphthol, sublimed, 100 lbs.	50 - 55
Beta-naphthol, tech., 100 lbs.	23 - 26
Beta-naphthylamine, sublimed, 100 lbs.	1.50 - 1.60
Carbazol, 100 lbs.	75 - 90
Cresol, U. S. P., in drums (100 lb.), 100 lbs.	12 - 15
Ortho-cresol, in drums (100 lb.), 100 lbs.	16 - 18
Cresylic acid, 92-99%, straw color, in drums, gal.	56 - 65
Cresylic acid, 75-97%, dark, in drums, gal.	51 - 58
Dichlorobenzene, 100 lbs.	0.6 - 0.9
Diethylaniline, 100 lbs.	65 - 70
Dimethylaniline, 100 lbs.	36 - 38
Dinitrobenzene, 100 lbs.	20 - 22
Dinitrochlorobenzene, 100 lbs.	22 - 24
Dinitronaphthalene, 100 lbs.	30 - 32
Dinitrophenol, 100 lbs.	33 - 35
Dinitrotoluene, 100 lbs.	22 - 24
Dip oil, 25%, car lots, in drums, gal.	24 - 26
Diphenylamine, 100 lbs.	59 - 65
H-acid, 100 lbs.	85 - 95
Meta-phenylenediamine, 100 lbs.	90 - 1.00
Monochlorobenzene, 100 lbs.	0.9 - 1.1
Monoethylaniline, 100 lbs.	1.00 - 1.20
Naphthalene crushed, in bbls., 100 lbs.	0.6 - 0.7
Naphthalene, flake, 100 lbs.	0.6 - 0.7
Naphthalene, balls, 100 lbs.	0.71 - 0.8
Naphthionate of soda, 100 lbs.	58 - 65
Naphthionine acid, crude, 100 lbs.	58 - 70
Nitrobenzene, 100 lbs.	10 - 12
Nitro-naphthalene, 100 lbs.	30 - 35



Nitro-toluene.....	lb.	15	—	17
N-W acid.....	lb.	1.15	—	1.30
Ortho-amidophenol.....	lb.	2.40	—	2.50
Ortho-dichlor-benzene.....	lb.	2.15	—	2.20
Ortho-nitro-phenol.....	lb.	.70	—	.75
Ortho-nitro-toluene.....	lb.	\$0.10	—	\$0.13
Ortho-toluidine.....	lb.	.14	—	.18
Para-amidophenol, base.....	lb.	1.25	—	1.30
Para-amidophenol, HCl.....	lb.	1.30	—	1.35
Para-dichlorbenzene.....	lb.	.17	—	.20
Paranitroaniline.....	lb.	.75	—	.80
Para-nitrotoluene.....	lb.	.55	—	.65
Para-phenylenediamine.....	lb.	1.55	—	1.60
Para-toluidine.....	lb.	.90	—	1.00
Phthalic anhydride.....	lb.	.35	—	.38
Phenol, U. S. P., drums.....	lb.	.14	—	.15
Pyridine.....	gal.	1.75	—	2.75
Resorcinol, technical.....	lb.	1.30	—	1.35
Resorcinol, pure.....	lb.	1.75	—	1.80
R-salt.....	lb.	.60	—	.70
Salicylic acid, tech., in bbls.....	lb.	.25	—	.25
Salicylic acid, U. S. P.....	lb.	.26	—	.32
Solvent naphtha, water-white, in drums, 100 gal.....	gal.	.27	—	.32
Solvent naphtha, crude, heavy, in drums, 100 gal.....	gal.	.14	—	.18
Sulphanilic acid, crude.....	lb.	.24	—	.26
Toluidine.....	lb.	1.20	—	1.30
Toluidine, mixed.....	lb.	.30	—	.35
Toluene, in tank cars.....	gal.	.25	—	.28
Toluene, in drums.....	gal.	.30	—	.35
Xylidines, drums, 100 gal.....	lb.	.40	—	.45
Xylene, pure, in drums.....	gal.	.40	—	.45
Xylene, pure, in tank cars.....	gal.	.45	—	.....
Xylene, commercial, in drums, 100 gal.....	gal.	.33	—	.35
Xylene, commercial, in tank cars.....	gal.	.30	—	.....

### Waxes

Beeswax, pure white.....	lb.	.38	—	.40
Japan.....	lb.	.17	—	.17

All other prices remain same as previous report

### Naval Stores

All prices are f.o.b. New York unless otherwise stated, and are based on earload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Rosin B-D, bbl.....	280 lb.	\$5.50	—	\$5.90
Rosin E-L.....	280 lb.	6.00	—	6.40
Rosin K-N.....	280 lb.	6.50	—	7.60
Rosin W. G.-W. W.....	280 lb.	7.65	—	8.30
Wood rosin, bbl.....	280 lb.	6.25	—	.....
Spirits of turpentine.....	gal.	1.25	—	1.26
Wood turpentine, steam dist.....	gal.	.85	—	.....
Wood turpentine, dest. dist.....	gal.	.70	—	.70
Pine tar pitch, bbl.....	200 lb.	.....	—	6.00
Tar, kiln burned, bbl. (500 lb.).....	bbl.	.....	—	10.00
Itcetort tar, bbl.....	500 lb.	.....	—	9.00
Rosin oil, first run.....	gal.	.36	—	.....
Rosin oil, second run.....	gal.	.38	—	.....
Rosin oil, third run.....	gal.	.46	—	.....
Pine oil, steam dist., sp.gr. 0.930-0.940.....	gal.	1.00	—	.....
Pine oil, pure, dest. dist.....	gal.	.95	—	.....
Pine tar oil, ref., sp.gr. 1.025-1.035.....	gal.	.46	—	.....
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.....	gal.	.35	—	.....
Pine tar oil, double ref., sp.gr. 0.965-0.990.....	gal.	.75	—	.....
Pine tar, ref., thin, sp.gr. 1.080-1.060.....	gal.	.25	—	.....
Hardwood oil, f.o.b. Mich., sp.gr. 0.960-0.990.....	gal.	.25	—	.....
Pinewood creosote, ref.....	gal.	.52	—	.....

### Fertilizers

Ammonium sulphate, f.a.s., N. Y., double bags.....	100 lb.	3.45	—	3.50
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Other quotations same as July 5th report

### Crude Rubber

All prices remain quotably unchanged

### Oils

#### VEGETABLE

The following prices are f.o.b. New York for earload lots.

Castor oil, No. 3, in bbls.....	lb.	\$0.11	—	\$0.11
Castor oil, AA, in bbls.....	lb.	.12	—	.12
China wood oil, in bbls.....	lb.	.12	—	.13
Coconut oil, Ceylon grade, in bbls.....	lb.	.08	—	.08
Coconut oil, Cochín grade, in bbls.....	lb.	.09	—	.09
Corn oil, crude, in bbls.....	lb.	.11	—	.11
Cottonseed oil, crude (f. o. b. mill).....	lb.	.09	—	.10
Cottonseed oil, summer yellow.....	lb.	.11	—	.11
Cottonseed oil, winter yellow.....	lb.	.12	—	.12
Linseed oil, raw, ear lots (domestic).....	gal.	.88	—	.89
Linseed oil, raw, tank cars (domestic).....	gal.	.84	—	.85
Linseed oil, boiled, in 5-bbl lots (domestic).....	gal.	.93	—	.94
Olive oil, denatured.....	gal.	1.15	—	1.17
Palm, Lagos.....	lb.	.07	—	.07
Palm, Niger.....	lb.	.06	—	.06
Peanut oil, crude, tank cars (f.o.b. mill).....	lb.	.10	—	.10
Peanut oil, refined, in bbls.....	lb.	.12	—	.12
Rapeseed oil, refined in bbls.....	gal.	.84	—	.85
Rapeseed oil, blown, in bbls.....	gal.	.88	—	.89
Soya bean oil (Manchurian), in bbls. N. Y.....	lb.	.12	—	.....
soya bean oil, tank cars, f.o.b. Pacific coast.....	lb.	.10	—	.....

#### FISH

Light pressed menhaden.....	gal.	\$0.51	—	.....
Yellow bleached menhaden.....	gal.	.53	—	.54
White bleached menhaden.....	gal.	.55	—	.56
Blown menhaden.....	gal.	.61	—	.....
Whale Oil, No. 1, crude, tanks, coast.....	gal.	.45	—	.48

### Miscellaneous Materials

All f.o.b. New York, Unless Otherwise Stated

Asbestos, erude No. 1, f.o.b., Quebec, Canada.....	short ton	\$700.00	—	\$750.00
Asbestos, shingle stock, f.o.b., Quebec, Canada.....	short ton	75.00	—	110.00
Asbestos, cement stock, f.o.b., Quebec, Canada.....	short ton	14.00	—	17.00
Barytes, ground, white, f.o.b. mills.....	net ton	17.00	—	23.00
Barytes, ground, off color f.o.b. mills.....	net ton	13.00	—	21.00
Barytes, floated, f.o.b. St. Louis.....	net ton	23.00	—	24.00
Barytes, erude f.o.b. mines.....	net ton	8.00	—	9.00
Casein.....	lb.	.10	—	.13
China clay (kaolin) crude, f.o.b. mines, Georgia.....	net ton	6.00	—	8.00
China clay (kaolin) washed, f.o.b. Georgia.....	net ton	8.00	—	9.00
China clay (kaolin) powdered, f.o.b. Georgia.....	net ton	12.00	—	20.00
China clay (kaolin) erude f.o.b. Virginia points.....	net ton	8.00	—	12.00
China clay (kaolin) ground, f.o.b. Virginia points.....	net ton	13.00	—	20.00
China clay (kaolin), imported, lump.....	net ton	16.00	—	20.00
China clay (kaolin), imported, powdered.....	net ton	30.00	—	35.00
Feldspar, No. 1 pottery grade.....	long ton	6.50	—	6.75
Feldspar, No. 2 pottery grade.....	long ton	5.75	—	5.90
Feldspar, No. 1 soap grade.....	long ton	7.00	—	7.50
Feldspar, No. 1 Canadian, for mill.....	long ton	21.00	—	22.00
Graphite, Ceylon lump, first quality, f.o.b. N. Y.....	lb.	.05	—	.05
Graphite, Ceylon chip.....	lb.	.04	—	.04
Graphite, high grade amorphous erude.....	ton	35.00	—	50.00
Kieselguhr, f.o.b. mines, Cal.....	per ton	40.00	—	.....
Kieselguhr, f.o.b. N. Y.....	per ton	50.00	—	55.00
Magnesite, calcined (powdered).....	per ton	8.00	—	12.00
Pumice stone, imported.....	lb.	.03	—	.05
Pumice stone, domestic, lump.....	lb.	.05	—	.05
Pumice stone, domestic, ground.....	lb.	.06	—	.07
Shellac, orange fine.....	lb.	.81	—	.82
Shellac, orange superfine.....	lb.	.83	—	.84
Shellac, A. C. garnet.....	lb.	.68	—	.69
Shellac, T. N.....	lb.	.79	—	.80
Silica, glass sand, f.o.b. Indiana.....	per ton	1.50	—	2.50
Silica, sand blast material, f.o.b. Indiana.....	per ton	2.50	—	5.00
Silica, amorphous, 250 mesh, f.o.b. Illinois.....	per ton	16.00	—	16.00
Silica, building sand, f.o.b. Pa.....	per ton	2.00	—	2.75
Soapstone.....	ton	12.00	—	15.00
Talc, 200 mesh, f.o.b. Vermont.....	ton	7.00	—	12.00
Talc, 200 mesh, f.o.b. Georgia.....	ton	7.50	—	12.00
Talc, 200 mesh, f.o.b. Los Angeles.....	ton	16.00	—	20.00

### Refractories

All prices remain same as previous report

### Ferro-Alloys

Ferrotitanium, 15-18%, f.o.b. Niagara Falls, N. Y.....	net ton	\$200.00	—	\$225.00
Ferrocromium, per lb. of Cr contained, 6-8% carbon, carlots.....	lb.	.10	—	.10
Ferrocromium, per lb. of Cr contained, 4-6% carbon, carlots.....	lb.	.10	—	.11
Ferromanganese, 78-82% Mn, domestic.....	gross ton	67.50	—	69.00
Ferromanganese, 78-82% Mn, German.....	gross ton	67.00	—	67.50
Spiegeleisen, 19-21% Mn.....	gross ton	36.00	—	.....
Ferromolybdenum, 50-60% Mo, per lb. of Mo.....	lb.	2.00	—	2.25
Ferrosilicon, 10-15%.....	gross ton	38.00	—	40.00
Ferrosilicon, 50%.....	gross ton	58.00	—	60.00
Ferrosilicon 75%.....	gross ton	115.00	—	120.00
Ferrotungsten, 70-80%, per lb. of contained W.....	lb.	.42	—	.45
Ferro-uranium, 35-50% of U, per lb. of U content.....	lb.	6.00	—	.....
Ferrovanadium, 30-40% per lb. of contained V.....	lb.	3.50	—	4.00

### Ores and Semi-finished Products

Coke, foundry, f.o.b. ovens.....	net ton	9.00	—	9.50
Coke, furnace, f.o.b. ovens.....	net ton	9.00	—	.....

Other prices remain quotably unchanged

### Non-Ferrous Metals

All f.o.b. New York Unless Otherwise Stated

Copper, electrolytic.....	lb.	13.875	—	.....
Aluminum, 98 to 99 per cent.....	lb.	19.00-20.00	—	.....
Antimony, wholesale lots, Chinese and Japanese.....	lb.	4.95-5.00	—	.....
Nickel, ordinary (ingot).....	lb.	36.00	—	.....
Nickel, electrolytic.....	lb.	39.00	—	.....
Nickel, ingot and shot, resale.....	lb.	32.00-33.00	—	.....
Monel metal, shot and blocks.....	lb.	30.00-31.00	—	.....
Monel metal, ingots.....	lb.	32.00	—	.....
Monel metal, sheet bars.....	lb.	35.00	—	.....
Tin, 5-ton lots, Straits.....	lb.	31.375	—	.....
Lead, New York, spot.....	lb.	5.75	—	.....
Lead, E. St. Louis, spot.....	lb.	5.50	—	.....
Zinc, spot, New York.....	lb.	5.75	—	.....
Zinc, spot, E. St. Louis.....	lb.	5.40	—	.....

#### OTHER METALS

Silver (commercial).....	oz.	\$0.71	—	.....
Cadmium.....	lb.	1.20-1.25	—	.....
Bismuth (500 lb. lots).....	lb.	2.00@2.10	—	.....
Cobalt.....	lb.	3.00@3.25	—	.....
Magnesium, ingots, 99 per cent.....	lb.	1.10	—	.....
Platinum.....	oz.	87.50	—	.....
Iridium.....	oz.	170.00@175.00	—	.....
Palladium.....	oz.	55.00@60.00	—	.....
Mercury.....	75 lb.	54.75@55.00	—	.....

# Industrial

Financial, Construction and Manufacturers' News

## Construction and Operation

### Alabama

**FORT PAYNE**—The Clay Products & Mining Corp., 150 East State St., Trenton, N. J., recently organized with a capital of \$1,500,000, is arranging for the immediate development of over 150 acres of clay and kaolin properties, lately acquired in this district, and will install a complete operating and producing plant. R. M. J. Smith is president; and Alfred L. Eccles, secretary.

### California

**IRVINGTON**—The Panama Soap Co. has concluded negotiations with the local Chamber of Commerce for the acquisition of a factory site, and will soon prepare plans for the erection of a new plant, estimated to cost about \$60,000, including equipment. The Chamber of Commerce is interested in the project.

**OWENSMOUTH**—The Standard Oil Co. of California, 200 Bush St., San Francisco, has plans under way for the construction of a local distributing plant, to include a number of 1-story buildings, to cover more than one acre of ground. Work will be commenced at an early date.

**SELMA**—The Fresno Tire & Rubber Co., Mattel Bldg., Fresno, has awarded a contract to W. L. Miller, Los Angeles, for the erection of its proposed new plant at Selma, to be 3-story, 60x250 ft., and estimated to cost about \$125,000, including machinery. It will be equipped for the manufacture of tires and other rubber products. John S. Bates, Rowell Bldg., Fresno, is engineer.

**SANTA BARBARA**—Considerable special machinery will be installed in the new addition to be erected at the flour milling plant of the Santa Barbara Milling Co., to be 23x90 ft. A. J. Wehrle is general manager.

**BAKERSFIELD**—The Associated Oil Co. and the Associated Supply Co., affiliated organizations, have plans nearing completion for the erection of a new oil distributing plant at 32nd and Chester Sts., a site recently acquired. It will include oil tanks, storage and pumping facilities, etc., and is estimated to cost about \$60,000. Headquarters of the first noted company are in the Sharon Bldg., San Francisco.

### Illinois

**NORTH CHICAGO**—The Chicago Hardware Co. is taking bids on a general contract for the erection of a 1-story addition, 70x100 ft., to be equipped as an enameling plant. It is estimated to cost about \$40,000. Shankland & Pingrey, 209 South La Salle St., Chicago, are engineers.

### Indiana

**HAMMOND**—A 1-story foundry, 60x130 ft., will be erected by the Calumet Tank & Mfg. Co., on Industrial Road, estimated to cost about \$75,000, including equipment. E. R. Kyler is president and treasurer.

**INDIANAPOLIS**—The Chapman Price Steel Co., Shelby St., has preliminary plans in progress for the erection of a large addition to its plant, comprising a number of buildings, estimated to cost about \$500,000, including equipment. Niles Chapman is president.

**GARY**—The National Tube Co., Frick Bldg., has completed plans for the erection of the initial units of its proposed new steel mill here, estimated to cost in excess of \$1,000,000. R. C. Patterson is company engineer; W. E. Schiller is president.

### Kentucky

**LOUISVILLE**—The Producers Wood Preserving Co., an interest of the Ayer & Lord Tie Co., 80 East Jackson St., Chicago, Ill., has broken ground for the erection of a new creosoting plant, estimated to cost about \$200,000, including equipment. The Leonard Construction Co., 37 South Wabash Ave., Chicago, has the general contract. Oscar S. Bond, Marion E. Taylor Bldg., Louisville, is in charge.

### Louisiana

**HOUMA**—The Industrial Committee of the Houma-Terrebonne Association of Commerce, J. H. Thatcher, chairman, is developing plans for the location of an industry at Houma to manufacture synthetic marble from crushed oyster shells. A site for the proposed plant is being selected.

**MONROE**—The Ouachita Natural Gas & Oil Co., P. O. Box 1199, has preliminary plans in progress for the construction of a new pipe line, with auxiliary equipment, from Swartz to Sterlington, La., for use in connection with its gasoline absorption plant and carbon works, about 9½ miles long, estimated to cost about \$60,000.

### Maryland

**EASTON**—The New Brick & Tile Co., Moreland Bldg., will break ground at once for the erection of its proposed new plant on local site for the manufacture of brick and tile products. It will consist of a main 1-story building, and is estimated to cost about \$45,000. The company was organized recently under state laws, with a capital of \$50,000. O. Fletcher Clark is secretary and treasurer, and Frank Ross, superintendent.

### Massachusetts

**MALDEN**—Wadsworth, Howland & Co., Inc., 139 Federal St., Boston, manufacturer of paints, varnishes, etc., has acquired property adjoining its Malden works on Green St., totaling about 28,600 ft., and another site in the vicinity, aggregating 200,000 ft., and will use the land for expansion. The proposed new buildings are expected to cost in excess of \$500,000. The last noted property will be used for the erection of a power plant.

**AMHERST**—Bids on a general contract have been taken for the erection of a new 3-story and basement chemistry and physics building at the Amherst Agricultural College, to be 94x195 ft. Ritchie, Parson & Taylor, Boston, are architects.

### Michigan

**MUSKEGON**—The Central Paper Co. has tentative plans under consideration for the erection of a 3-story addition to its mill on Richard St., estimated to cost about \$200,000, including machinery. E. J. Geddes is secretary.

**LANSING**—The Capital Glass Co. has completed the erection of a new local plant and will commence operations at once for the manufacture of mirrors and other glass products, primarily for automobile service.

**KALAMAZOO**—The Kalamazoo Vegetable Parchment Co., manufacturer of parchment papers, has awarded a contract to H. L. Vanderhorst, Grand Rapids National Bank Bldg., Grand Rapids, for the erection of the proposed new addition to its mill, to be 2-story, 2-machine capacity, estimated to cost about \$400,000, including machinery. Billingham & Cobb, Press Bldg., Kalamazoo, are architects; J. Kindleberger is president and manager.

### Missouri

**KANSAS CITY**—The Central Paper Box Co., 2935 Bellevue Ave., has completed plans and will soon break ground for the erection of a new 2-story and basement plant, 125x150 ft., on Bellevue Ave., near 29th St. Hans Von Unwerth, 500 Reliance Bldg., Kansas City, is architect.

### New Jersey

**TRENTON**—The Resolute Pottery Co., 3rd St., manufacturer of sanitary earthenware, has filed plans for the erection of a 1-story plant addition to cost about \$10,000.

**NEWARK**—The Premier Rubber Co., recently organized with a capital of 50,000 shares of stock, no par value, to manufacture a general line of rubber specialties, has acquired the factory at 215-24 New St., at Hoyt St., under a 5-year lease. Possession will be taken at once and equipment installed. It is proposed to have the plant ready for service early in August. The company is headed by John W. Stoddard and W. Howard Demarest, 790 Broad St., Newark.

**NEWARK**—Fire, June 26, damaged a portion of the plant of L. Mundet & Co., Long Ave., Hillside section, manufacturers of cork products. An official estimate of the loss has not been announced.

### New York

**NEW YORK**—The American Smelting & Refining Co., 120 Broadway, has preliminary plans under way for the erection of a new byproducts coke plant on site selected in the Coahuilla district, Mexico, estimated to cost in excess of \$5,000,000, including machinery. The proposed plant will consist of a series of buildings, to be equipped for different features of production. William Loeb, Jr., is vice-president in charge.

**NEW YORK**—The International Carbon Corp., operated under the direction of the Atlas Powder Co., 200 Fifth Ave., and the Columbian Carbon Co., is considering plans for the establishment of a foreign branch plant on site to be selected in France. The company specializes in the production of a decolorizing carbon, known as "Darco," and has succeeded to the business of the Darco Corp., with plant at Marshall, Tex., recently placed in operation. A common stock issue of \$1,210,000 is being sold, the proceeds to be used, in part, for the proposed expansion.

### New Mexico

**RATION**—The Ideal Mining & Milling Co. has tentative plans under consideration for the erection of a new flotation plant at its local properties, to have an initial output of about 50 tons a day. A number of improvements are now being made at the works, including the installation of new machinery.

**SILVER CITY**—The Tonopah-Belmont Co., Tonopah, Nev., has acquired the properties of the Wyman Silver Mining Co., near Silver City, and plans for extensive development and production. Equipment for this purpose will be installed at an early date.

### North Carolina

**WINSTON-SALEM**—The Engineering Division, Department of Public Works, has plans under way for the installation of new filtration equipment at the municipal waterworks. A coagulating basin, six filters, ariator, washing tower, and other equipment will be installed. Bids are expected to be asked early in August.

**BALDWIN**—The National Soapstone Co., First National Bank Bldg., Roanoke, Va., has awarded a general contract to the Virginia Bridge & Iron Co., Roanoke, for the erection of a new plant at Baldwin, consisting of three buildings, 60x115 ft., 30x45 ft., and 30x45 ft., respectively. A list of equipment for installation has been arranged, and this feature of the work will be arranged at an early date. C. R. Williams is general manager.

### Ohio

**OAK HARBOR**—The Liberty Cut Glass Co. is arranging for extensions in its plant to double, approximately, the present output. Considerable new equipment will be installed. J. H. Fisher is general manager.

**WARREN**—The Youngstown Steel Co., Realty Trust Bldg., Youngstown, O., has awarded a contract for the clearing of the site at Warren, for the construction of its proposed new steel mill, estimated to cost in excess of \$2,500,000. Plans for the plant are in course of preparation. H. Z. Bixler is company engineer in charge.

### Oklahoma

**ADA**—The Oklahoma Portland Cement Co. is making a number of improvements and extensions in its local mills, and is completing the installation of a second kiln in its recently constructed "wet process" plant. The other mill, or "dry process" plant, will be overhauled at once. Work is under way on a new power plant.

**MUSKOGEE**—The Oklahoma Producing & Refining Co., a subsidiary of the Pure Oil Co., is considering tentative plans for extensions in its local oil refinery. The expansion will be designed to handle the output of the Oklahoma Central Oil Co., recently acquired for a consideration said to be close to \$5,000,000, and with production approximating 5,400 bbl. daily.

### Pennsylvania

**NEW CASTLE**—The Elliott-Blair Steel Co. is planning for the erection of an addition to its plant, consisting of a number of buildings, estimated to cost in excess of \$200,000, including equipment.

**PHILADELPHIA**—H. Swoboda & Son, Inc., 1027 North Bodine St., manufacturer of leather products, has foundation work under way for the erection of a 1-story



addition to its plant to cost about \$50,000. G. Swoboda is president.

**PHILADELPHIA**—Fire, June 25, destroyed a portion of the storage and distributing plant of the Pennsylvania Synthetic Gas & Chemical Co., 63rd St., near Chester Ave., with loss approximating about \$15,000.

### Tennessee

**CRAB ORCHARD**—The Southern States Lime Corp. is said to be planning for the erection of a new hydration plant to cost about \$20,000. N. D. Walker is general manager.

**HARRIMAN**—The City Council is considering the installation of a new filtration plant at the municipal waterworks. J. C. Laird is city engineer.

### Texas

**REFUGIO**—The Refugio Glass Works, Inc., National Bank of Commerce Bldg., San Antonio, Tex., recently organized with a capital of \$75,000, has selected a site at Refugio, near San Antonio, for the erection of a new plant for the manufacture of high pressure glass bottles, glass panels and kindred specialties. Work will be commenced at once, and it is proposed to have the plant ready for operation early in the fall. W. L. Napier is manager.

**DALLAS**—The Texas Chinaware & Novelty Pottery Co., recently organized with a capital of \$50,000, will soon commence the erection of a new plant at Betterson Circle, Oak Cliff district, for the manufacture of whiteware, china tops and other pottery products. The initial works will consist of 3 pottery kilns and 3 kilns for bisque ware. The new company is headed by H. G. Stern, J. D. Robinson and P. A. Angelsburg.

**STAMFORD**—The Stamford Cotton Oil Co. is reported to be planning for the rebuilding of its local plant, partially destroyed by fire, June 23, with loss estimated at about \$40,000, including equipment. J. L. Jones is president, and W. A. Ernest, general manager.

**WEST DALLAS**—The Clayton Refining Co. has remodeling work under way on the local oil refinery, formerly operated by the Hercules Refining Co. The plant will be increased to develop a daily capacity of about 5,000 bbl. The work is estimated to cost about \$45,000.

**ELECTRA**—D. E. DeCourse, Devol, Okla., and associates, have acquired the local oil refinery of the Beaver Electra Refining Co., for a consideration stated at \$95,000. The new owners will organize a company and operate the plant. It is proposed to make a number of improvements and extensions.

### West Virginia

**BELLE**—The Belle Alkali Co. will soon commence the erection by day labor of its proposed 2-story plant addition, 50x100 ft., to be equipped for the manufacture of caustic soda, chlorine, etc., estimated to cost close to \$100,000. D. W. Stubblefield is general manager.

## Industrial Developments

**GLASS**—The United States Window Glass Co., Jewella, near Shreveport, La., has placed its new local plant in operation, and will give employment to a working force of about 750 men. The factory was completed recently at a cost of close to \$3,000,000.

The Interstate Window Glass Co. has resumed partial operations at its Plant No. 3, following a suspension for more than a year past. Tank fires have been started and it is expected to place the entire plant in full operation by August 1, giving employment to about 200 men. It is said that orders on hand insure continuous production for a considerable period. The company is also arranging for the early resumption of manufacture at its plant at Okmulgee, Okla., and it is expected to through this entire plant in service during July. Tank fires have been lighted.

Manufacturers of glass bottles and containers in the vicinity of Vineland, N. J., report an improved demand for production, and surplus stocks are being depleted rapidly. Opal ware and kindred material containers are in demand considerably in excess of normal.

**CERAMIC**—The John S. E. Pardee Co., Maple Shade, N. J., manufacturer of brick, is operating under maximum production, with a full working force. The company has just completed the installation of a new brick-making machine to provide an additional output of about 40,000 bricks per hour.

J. E. Thompson, recently appointed receiver for the Guernseyware Co., Cambridge, O., manufacturer of vitrified china-

ware products, will continue the plant in operation.

**OKLAHOMA**—Gosden & Co., Bigheart and Tulsa, Okla., has advanced production at its refineries from 35,000 to 40,000 bbl. per day.

Following refinancing the Constantine Refining Co., Tulsa, Okla., is planning for the resumption of operations at its plant at Devol, and in the district west of Tulsa. It is expected to develop full capacity at an early date.

**IRON AND STEEL**—The Reading Iron Co., Reading, Pa., has increased production to the highest point within the past 24 months. All plants at Pottstown, Columbia, Danville and Birdsboro, are now in service, giving employment to a working force about 75 per cent of normal. Operations were recently resumed at the eight furnaces at the Glasgow puddle mill of the company, following a shut down for more than a year past.

The Carnegie Steel Co., Pittsburgh, Pa., is now operating 38 blast furnaces, against a total of 35 on May 5, and 34 early in April, at the commencement of the coal strike. It is planned to add to the list of active stacks at an early date. At its Union mills, the company has increased the operating schedule to 90 per cent of normal, while the Ohio works have 14 open-hearth furnaces in service, with a production basis of 93 per cent of normal.

The Gulf States Steel Co., Gadsden, Ala., is maintaining production at close to normal at its local mills. The wages of mill men have been advanced 10 per cent, effective July 1.

Blast furnace operations in the Mahoning and Shenango Valley districts of Ohio are now at the highest point of any time within the last 18 months. In the first noted section, 18 out of 27 stacks are in service, bringing production to a point of 80 per cent of normal; in the Shenango Valley, 8 out of 20 stacks are on the producing list.

Following a shut down for close to two years past, the Bon Air Coal & Iron Corp., Nashville, Tenn., is arranging to blow in its blast furnace at Allen's Creek around the middle of July. The wood distillation plant of the company at Lyles will be placed in service at the same time, after a similar idle period.

The Wheeling Steel & Iron Co. has advanced production from 45 to 75 per cent of normal at its Benwood, W. Va., plants, adding about 400 men to the working force. The company has placed an additional sheet metal in service at the plant of its Whitaker-Glessner division, Martin's Ferry, O., bringing manufacture up to about 66 per cent of normal.

**COKE**—The Woodward Iron Co., Birmingham, Ala., is arranging for the operation of 30 more byproduct coke ovens at its plant, bringing the active list up to 200 ovens. The company is operating 4 blast furnaces.

Coke production in the Connellsville, Pa., district is being increased. During the last week in June, 3 plants resumed operations, bringing the number of active plants up to 39. Production in this section has been advanced from 58,663 to 66,850 tons per week.

Arrangements are being made for the early resumption of operations at the coke ovens in the vicinity of Dawson, N. M., which have been closed down for about 2 years past. About 200 ovens are available for immediate lighting.

The H. C. Frick Coke Co., Connellsville, Pa., is increasing operations at its different plants. A total of 50 ovens have been lighted at the Leisenring No. 1 Plant; 40 ovens have been started at the Lomond No. 2 Plant; and 50 ovens have been placed in blast at the Oliphant works.

**MISCELLANEOUS**—The Lehigh Portland Cement Co., New Castle, Pa., has advanced production to a full capacity basis, with full working force, at its 3 local mills.

The Barrett Co., Philadelphia, Pa., manufacturer of prepared roofing, paper products, etc., has increased the wages of employees at its Elizabeth, N. J., works 10 per cent. About 200 operatives are affected.

The Chino Copper Co., Silver City, N. M., is increasing operations at its properties, and is now giving employment to about 700 men.

The Vanadium Corp., Pittsburgh, Pa., manufacturer of ferro-vanadium, etc., has recently resumed operations at its plant at Bridgeville, Pa.

The Mathieson Alkali Works, Providence, R. I., is running at about 80 per cent of capacity at its plants. Following the recent acquisition of the Commonwealth Co., plans for extensive production are being developed in the line of general chemicals, supplementing the current manufacture of caustic soda, chlorine and bleaching powder.

## Capital Increases, Etc.

**THE W. H. LOOMIS TALC CORP.**, Gouverneur, N. Y., has filed notice of increase in capital from \$148,000 to \$173,000.

**THE MORGAN CHEMICAL CORP.**, Ogdensburg, N. Y., has filed notice of dissolution.

**THE ATLANTIC REFINING CO.**, 3144 Passyunk, Philadelphia, Pa., operating a local oil refinery, with similar plants at Franklin and Pittsburgh, Pa.; and Brunswick, Ga., is disposing of a bond issue of \$15,000,000, a portion of the proceeds to be used for general expansion and operation.

**THE BRIDGEPORT BRASS FOUNDRY, INC.**, Bridgeport, Conn., has filed final notice of company dissolution.

The plant and property of the **CENTURY-PLAINFIELD TIRE CO.**, Plainfield, N. J., manufacturer of tires and other rubber products, will be sold by the receiver, Charles R. McNair, 147 Ellison St., Paterson, N. J.

**THE TEXIGAN OIL PRODUCTS CO.**, Saginaw, Mich., has filed notice of increase in capital from \$100,000 to 150,000.

**THE MINER-EDGAR CO.**, Blanchard St., Newark, N. J., manufacturer of chemicals and producer of paper clays, has arranged for a bond issue of \$1,500,000, a portion of the proceeds to be used for expansion and additions to working capital. Henry M. Miner is president.

**HOLTON & CO.**, Detroit, Mich., a Delaware corporation, have filed notice of change of name to the Century Oil Co., at the same time increasing their capital from \$100,000 to \$250,000.

**THE MUTUAL SERVICE OIL CO.**, Cleveland, Ohio, has filed notice of increase in capital from \$100,000 to \$250,000, for proposed expansion.

**THE WARREN FOUNDRY & MACHINE CO.**, Phillipsburg, N. J., has filed notice of change of name to the Warren Foundry & Pipe Co., to devote operations to the manufacture of cast iron pipe, and other foundry products.

**THE SAGUENAY PULP & POWER CO.**, Montreal, Que., is arranging for a bond issue of \$6,400,000, a portion of the proceeds to be used for general expansion.

**THE PUBLIC SERVICE GAS CO.**, Newark, N. J., operating artificial gas plants, has been granted permission by the Public Service Commission to issue additional capital stock in an amount of \$2,500,000, a portion of the proceeds to be used for extensions and betterments.

William C. Matlack has been appointed temporary receiver for the **RAHITAN ANILINE WORKS**, Rahitan, N. J., manufacturer of aniline oils and kindred specialties.

**THE AMERICAN LIME & STONE CO.**, Bellefonte, Pa., operating a local lime manufacturing plant, is disposing of a bond issue of \$1,100,000, a portion of the proceeds to be used for plant extensions and betterments. Work is under way on one of the largest single lime-burning plants in this country at Bellefonte. The company is operated by the Charles Warner Co., Wilmington, Del. Charles Warner is president of both organizations.

Charles N. Coddling, Elizabeth, N. J., and William H. Dieker, Jersey City, N. J., have been appointed receivers for **BYRON HEFFERMAN & CO.**, manufacturers of camphor substitutes, with plant in the first noted city.

**THE AVRI DRUG & CHEMICAL CO.**, 421 Johnston Ave., Jersey City, N. J., has filed an involuntary petition in bankruptcy.

## New Companies

**THE BLUE & WHITE SOAP CO.**, Boston, Mass., has been incorporated with a capital of \$50,000, to manufacture soaps. David Harvey is president, and Abraham Superior, 89 Humboldt Ave., Boston, treasurer.

**WILLIAM G. MULLER, INC.**, New York, N. Y., has been incorporated with a capital of \$200,000, to manufacture chinaware products. The incorporators are William G. Muller, F. Heinrich and W. G. Bushell, 67 Wall St., New York. The last noted represents the company.

**THE OIL PRODUCTS CO. OF BALTIMORE, INC.**, 302-4 North Holliday St., Baltimore, Md., has been incorporated with a capital of \$35,000, to manufacture oils, paints, etc. The incorporators are John G. Platt, Alton L. Kibler and James B. Thompson.

**THE KENTUCKY CARBON & CHEMICAL CO.**, Louisville, Ky., has been incorporated with a capital of \$50,000, to manufacture chemicals and chemical byproducts. The incorporators are Harry Reid, Indianapolis, Ind., Robert G. Gordon and Owsley Brown, Louisville.

**THE ASBESTOS FIBRE CO.**, New York, care of S. V. Elting, 46 Cedar St., represent-

ative, has been incorporated with a capital of \$275,000, to manufacture asbestos products. The incorporators are A. Harnick, L. A. Fiescher and G. Levy.

THE ATLANTIC GLASS MFG. CO., care of the Corporation Trust Co. of Delaware, Wilmington, Del., representative, has been incorporated with a capital of \$500,000, under state laws, to manufacture glass products.

THE CEROK MINERAL PAINT CO., 2528 West 48th St., Chicago, Ill., has been incorporated with a capital of \$75,000, to manufacture paints and kindred products. The incorporators are Louis G. Hughes, J. B. Harris and John R. Nelson.

THE LIGHTNING PRODUCTS CO., 79 Williams St., Orange, N. J., has been incorporated with a capital of \$125,000, to manufacture polishes and kindred products. The incorporators are Albert Kellerman, Louis I. and Bernhard Shapiro.

THE DEERFIELD VALLEY PAPER CO., Portland, Me., has been incorporated with a capital of \$650,000, to manufacture paper products. E. U. Mann is president; M. D. Mills, treasurer; and Charles D. Booth, Portland, representative.

THE THOMAS OIL CORP., Houston, Tex., care of the Colonial Charter Co., Ford Bldg., Wilmington, Del., representative, has been incorporated under state laws, with a capital of \$100,000, to manufacture petroleum products. The incorporators are S. M. Griffin, O. S. Thomas and B. A. Perryman, all of Houston.

THE NORTH RIVER CHEMICAL CO., New York, N. Y., care of A. J. Levine, 299 Broadway, representative, has been incorporated with a capital of \$25,000, to manufacture chemicals and chemical byproducts. The incorporators are G. W. Frederick, E. Moser and S. A. Junghans.

THE OWENSBORO WALL PLASTER CO., Owensboro, Ky., has been incorporated with a capital of \$5,000, to manufacture plaster and kindred products. The incorporators are J. T. Harrison and P. A. Yager, both of Owensboro; W. L. and E. H. Delker, both of Henderson, Ky.

THE EATON, CRANE & PIKE CO., Pittsfield, Mass., operating a local mill for the manufacture of paper products, has filed articles of incorporation under state laws, with capital of \$3,500,000, to provide for proposed expansion. Arthur W. Eaton is president; and William H. Eaton, treasurer, both of Pittsfield.

THE EDWARD NEWBY OIL CO., Houston, Tex., care of H. G. Eastburn, Ford Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws, with capital of \$1,000,000, to manufacture petroleum products. The incorporators are E. E. Newby, Houston; J. C. Hought and I. H. Schwartz, both of Indianapolis, Ind.

THE SOUTHERN FERTILIZER WORKS, Orlando, Fla., has been incorporated with a capital of \$100,000, to manufacture commercial fertilizer products. T. L. Payne is president; J. P. Williams, vice-president; and R. H. F. Dade, secretary, all of Orlando.

THE PENDLETON OIL MILL, INC., Pendleton, S. C., has been incorporated with a capital of \$50,000, to manufacture oil products. E. N. Sitton is president; Cema Chreitsberg, vice-president; and B. M. Aull, secretary, all of Pendleton.

THE CHASY LIMESTONE CORP., New York, N. Y., has been incorporated with a capital of \$300,000, to manufacture lime and operate limestone properties. The incorporators are H. C. Jeffries, W. H. Higginbotham and W. H. Williams, 32 Nassau St., New York, the last noted represents the company.

THE WOOD COUNTY COTTON OIL CO., Mineola, Tex., has been incorporated with a capital of \$56,000, to manufacture cotton oil products. The incorporators are W. W. Ferry, R. Bergfield and H. W. Meredith, all of Mineola.

THE COMMERCIAL WALL PAPER MILL, INC., 1416 South Talman Ave., Chicago, Ill., has been incorporated with a capital of \$250,000, to manufacture wall papers and other paper products. The incorporators are James E. Hauronic, R. S. Tutthill and Frank P. Page.

THE INTERNATIONAL SUGAR CO., Washington, D. C., care of the Delaware Registration Trust Co., 900 Market St., Wilmington, Del., has been incorporated under Delaware laws, with a capital of \$31,000,000, to operate sugar refineries. The incorporators are Howard Allen, Charles E. Wynne and Frank J. Kelley.

THE ALLEY GLASS CO., Shinnston, W. Va., has been incorporated with a capital of \$10,000, to manufacture glass products. The incorporators are L. E. Alley, and Paul E. Tetrick.

THE MINTON A. EDGAR CO., Metuchen, N. J., has been incorporated with a capital

of \$50,000, to operate clay properties. The incorporators are N. G. Edgar, M. A. Rick and Milton A. Edgar, 115 Lake Ave., Metuchen.

THE JOY CHEMICAL CORP., Brooklyn, N. Y., represented by H. A. Eberhardt, 92 William St., New York, has been incorporated with a capital of \$10,000, to manufacture chemicals and chemical byproducts. The incorporators are Earl G. Hart, Jr., H. J. Cluskey and C. B. Brucker.

THE CLINCHFIELD SAND & FELDSPAR CORP., Bristol, Va., has been incorporated with a capital of \$600,000, to operate feldspar properties for the production of commercial feldspar. Henry N. Hanna, 296 Water St., Baltimore, Md., is president, and George M. Warren, Bristol, Va., secretary.

THE DYESTUFF & CHEMICAL CO., Wilmington, Del., has been chartered under state laws, with a capital of \$25,000, to manufacture chemicals, chemical byproducts, dyestuffs, etc. The incorporators are Walter A. Ryan, H. G. Stevens and George C. Hering, Jr., all of Wilmington. The last noted represents the company.

THE C. E. BECKMAN CO., New Bedford, Mass., has been incorporated with a capital of \$100,000, to manufacture oils, paints, etc. Charles E. Beckman, 243 Arnold St., New Bedford, Mass., is president and treasurer.

THE STEVENS PAPER CO., New York, N. Y., has been incorporated with a capital of \$50,000, to manufacture paper products. The incorporators are R. L. Stevens, Jr., R. A. Smith, J. S. Beach and G. R. Williams, 165 Broadway, New York. The last noted represents the company.

THE CARL FISCHER TIRE & RUBBER CO., 1414 South Michigan Ave., Chicago, Ill., has been chartered under state laws, to manufacture tires and other rubber goods. The incorporators are Carl R. Fischer, Francis A. Winship and John C. Dewolf.

THE COLONIAL CONCRETE PRODUCTS CO., 111 Collins Ave., Baltimore, Md., has been incorporated with a capital of \$60,000, to manufacture concrete blocks, and other cement products. The incorporators are George L. Jones and J. R. Carroll.

THE UNITED CHEMICAL & INDUSTRIAL CORP., Baltimore, Md., care of J. Bannister Hall, Jr., Calvert Bldg., has been incorporated with a capital of 30,000 shares of stock, no par value, to manufacture chemicals and chemical byproducts.

THE TRIPLE REFLECTOR CORP., Philadelphia, Pa., care of the Corporation Guarantee & Trust Co., Land Title Bldg., has been incorporated under Delaware laws, with a capital of \$100,000, to manufacture glass products.

LORIO SUGARS, INC., Lakeland, Fla., has been incorporated with a capital of \$25,000, to operate a local sugar refinery. A. A. Lorio is president; L. F. Lorio, vice-president; and W. A. Lorio, secretary and treasurer, all of Lakeland.

THE RIVERTON MILLS, CORP., Riverton, Va., has been incorporated with a capital of \$40,000, to manufacture commercial fertilizer products. B. J. Hillidge is president; and W. J. Dearing is secretary, both of Front Royal, Va.

THE HEINZERLING OIL CORP., Vernon, Tex., has been incorporated with a capital of \$30,000, to manufacture petroleum products. The incorporators are J. B. Brady, and W. H. Heinzerling, both of Vernon.

THE STATES RUBBER & SUPPLY CO., 227 West Randolph St., Chicago, Ill., has been incorporated with a capital of \$10,000, to manufacture rubber specialties. The incorporators are Arthur Cordell and Michael C. Yunker.

THE PETERSON PATENT LEATHER CO., Woburn, Mass., has been incorporated with a capital of \$6,000, to manufacture leather products. Brunswick G. Fowler is president; and Alfred W. Peterson, 61 Bow St., Woburn, treasurer.

THE BAKER REFINING & MFG. CO., Jacksonville, Fla., has been incorporated with a capital of \$10,000, to manufacture oils. H. Baker, Jr., is president; J. T. Meyers, vice-president; and H. T. Miller, secretary, all of Jacksonville.

THE NON-PUNCTURE TIRE CO., Binghamton, N. Y., care of Mangan & Mangan, Binghamton, has been incorporated with a capital of \$50,000, to manufacture tires and other rubber products. The incorporators are G. A. Reynolds, Sr. and Jr.; and F. H. Wilbur.

THE O'BANNON AIRLESS TIRE CORP., New York, N. Y., care of Woodburn Martin, Georgetown, Del., representative, has been incorporated under Delaware laws with a capital of \$250,000, to manufacture tires and other rubber products. The incorporators are J. V. Pacher, A. J. Prutting and E. H. Klingefus, all of New York.

## Industrial Notes

THE TITAN IRON & STEEL CO., INC., Newark, N. J., manufacturing mechanically puddled wrought iron, has announced the appointment of W. Woodward Williams as vice-president. Mr. Williams' long experience in the iron and steel industry began immediately upon his graduation from Harvard University in 1905. After 6 years in the mills of the Carnegie Steel Co. at Pittsburgh, Duquesne and Youngstown, Mr. Williams entered the sales department of the Bourne-Fuller Co. of Cleveland and was later appointed manager of its Pittsburgh office. In January, 1914, he became general manager of sales of the A. M. Byers Co., Pittsburgh, and subsequently was made its general manager. In August, 1919, he became general manager of the Reading Iron Co., and afterward was elected vice-president, in charge of sales and operations. In September, 1920, he became associated with the Pittsburgh Gage & Supply Co., jobber of wrought iron merchant pipe in the United States, resigning the vice-presidency on May 31, 1922, to take the vice-presidency of the Titan Iron & Steel Co., Inc.

THE ZELLER MFG. CO. has announced, through Mr. Hugo Zeller, that, contrary to recent trade rumors, there is no connection between the organization and any other company manufacturing lacquer. The Zellers at one time were actively and financially interested in the Egyptian Lacquer Mfg. Co., but since the Zeller Lacquer Mfg. Co. was formed, the Zellers sold out their interest in the Egyptian company so that there is now no connection whatsoever between the two concerns.

THE CHICKASAW REFINING CO., Ardmore, Okla., at a recent meeting of stockholders elected S. A. Apple as president. Other officers elected were: Erret Dunlap and Perry D. Maxwell, vice-presidents; F. A. Schneider, secretary-treasurer; and John Holt, assistant secretary-treasurer.

THE IRON PRODUCTS CORP., New York, and its subsidiaries, the Central Foundry Co., the Central Iron & Coal Co., the Central Radiator Co. and the Molby Boiler Co., announce the opening of a district sales office in the Jefferson County Bank Bldg., at Birmingham, Ala., June 1, 1922. T. C. Hyde will be manager of the new office, under the direction of J. L. Brierton, vice-president and general manager of the Central Iron & Coal Co.

## Manufacturers' Catalogs

THE CRESCENT PUMP CO., Detroit, Mich., has issued Bulletin 5, on Crescent "Roto-Piston" dry vacuum pumps. This 12-page booklet illustrates and describes the pumps, tells of the movement, details of foundation, guarantee and a list of the applications for vacuum.

THE THWING INSTRUMENT CO., Philadelphia, Pa., has issued Bulletin 11, which illustrates and describes the company's complete line of indicating and recording radiation pyrometers.

## Coming Meetings and Events

AMERICAN CERAMIC SOCIETY will hold a summer excursion meeting to Rochester, Montreal, Ottawa, Kingston, Toronto, Hamilton, Niagara Falls and Buffalo, Aug. 13-19.

AMERICAN CHEMICAL SOCIETY will hold its fall meeting in Pittsburgh, Pa., Sept. 8 to 9.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its fall meeting in Montreal, Sept. 21, 22 and 23. Headquarters will be at the Windsor Hotel.

AMERICAN GAS ASSOCIATION will hold its annual convention and exhibition at Atlantic City, Oct. 23 to 28.

AMERICAN SOCIETY FOR STEEL TREATING will hold its International Steel Exposition and Convention in the General Motors Bldg., Detroit, Mich., Oct. 2 to 7.

ANNUAL SAFETY CONGRESS OF THE NATIONAL SAFETY COUNCIL will be held in Detroit, Mich., Aug. 28-Sept. 2.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (EIGHTH) will be held in New York Sept. 11-16.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace Dec. 7-13, with the exception of the intervening Sunday.

NEW JERSEY CHEMICAL SOCIETY has discontinued meetings for the summer, but will resume them in October.